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A re-examination of variability in handaxe form in the British Palaeolithic.

PhD Archaeology

I, Kate Emery confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

ABSTRACT

The antiquity of handaxes was first noted over 200 years ago (Frere, 1800) and since then archaeologists have attempted to categorise and explain them. We are now much closer to elucidating the answers to why and how they were made, what they were used for and what they signify about past hominin behaviour. In a British context, several authors have contributed significant leaps forward in the comprehension of these processes, most notably, Roe (1968), Wymer (1968) and more recently McPherron (1995), White (1998a) and Ashton (2003). The work pioneered by Roe (1968) emphasised the variability present within handaxe-dominated assemblages from the British Palaeolithic and attempted to place this variation within an objective typological framework.

Subsequent authors have utilised Roe's methodology to attempt to ascertain the basis for this metrical variability both within and between handaxe-dominated assemblages, positing causal factors such as raw material (Ashton and McNabb, 1994; White, 1998a), resharpening (McPherron, 1995) and cultural design (Wenban-Smith, 2004). This study examines the basis and methodology of these hypotheses through the technological analysis of twenty two British Palaeolithic localities. The focus of this examination is Roe's decision to divide assemblages into Point, Ovate and Cleaver Traditions, groupings which have become the standard through which to understand and classify handaxe variability within Britain.

The results of this analysis indicate that resharpening is a key factor in determining handaxe shape and that metrical classification alone can never deliver us the types of tool-specific information necessary to make sense of observed patterning in the archaeological record. This suggests that it is perhaps time to move towards a new analytical framework for handaxes, one in which the fluidity of form during handaxe use-life (Shott, 1989) is taken into account. Moving beyond Roe's (1968) paradigm will allow us to engage with the processes and rhythms of the Lower and Middle Palaeolithic chaîne opératoire in a way simply unavailable through metrical classification.

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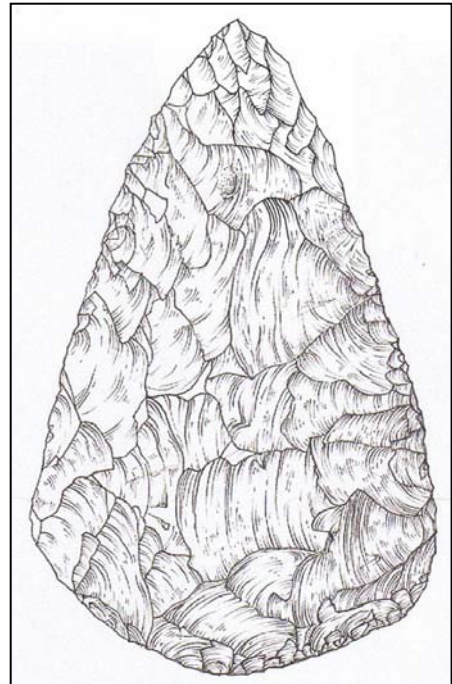
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CHAPTER ONE : INTRODUCTION

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The handaxe is perhaps one of the most distinctive symbols of the Palaeolithic. From their first appearance, handaxes have been created, used and discarded by hominins for nearly 1.6 million years (Roche *et al*, 2003, Asfaw *et al*, 1992). Handaxes were first discarded in substantial numbers by *Homo heidelbergensis* at sites such as Boxgrove, High Lodge and Warren Hill dated to 500,000 BP (MIS 13) (Roberts and Parfitt, 1999; Wymer, 1999). Assemblages in the Lower Palaeolithic that contain handaxes are dominated by them as the major tool type and prepared core technology is rare or absent (Roe, 1968 but see Ashton and White, 2003). Handaxes remain the dominant element of assemblages throughout the British Lower Palaeolithic (500,000 BP – 300,000 BP) (Wymer, 1999). Within this period of apparent technological stasis, the majority of handaxes appear at least superficially similar in form (Wynn and Tierson, 1990), yet there are elements that appear to differ from the norm, such as the plano-convex handaxes from Wolvercote (Tyldesley, 1986) and the twisted-ovates from Elveden and Hitchin (White, 1998b), suggesting the possibility of more complex variation.

The British Middle Palaeolithic (c.300,000 BP – 40,000 BP) (White and Jacobi, 2002) represents the greatest period of change for the role of the handaxe. The emergence and subsequent dominance of the Levallois method of manufacture appears to marginalise the handaxe during the Early Middle Palaeolithic (300,000 BP – 180,000 BP). Levallois technology is characterised by the removal of predetermined flakes from a prepared core (Boeda, 1995). Several authors believe that the early stages of Levallois technology can be seen in the reduction of bifacial implements, (c.f. Tuffreau, 1995; Ashton and White, 2003) and although both

handaxes and Levallois products are found in assemblages throughout this period, it is now believed that they are complementary, with Levallois technology replacing the functional role of handaxes (White, Scott and Ashton, 2006). There is a scarcity of sites in Britain for the key periods of Levallois dominance and so data about Levallois assemblages has to be obtained through European analogies (Dibble and Bar-Yosef, 1995).

Alongside the use of Levallois technology in the European Middle Palaeolithic, the introduction of a wide range of scrapers, points, notched and denticulated tools leads to the establishment of the Mousterian technocomplex (c.115,000-40,000BP) (Mellars, 1996). The earlier assemblages also contain few or no handaxes and it appears as if the marginalisation of the handaxe is complete. However, the later Middle Palaeolithic (70,000 BP – 40,000 BP) sees a change in nature with Mousterian of Acheulean Tradition A (MTA A) assemblages from Britain and France containing a substantial percentage of handaxes (Dibble and Mellars, 1992; Soressi, 2004). MTA A assemblages form part of the wider Mousterian technocomplex, are found at the top of the chronological sequence and are characterised by a change in both typology and technology, relating particularly to the presence of two ‘type fossils’: the bout coupé handaxe and the typical backed knife (Mellars, 1992). MTA A and Acheulean handaxes appear superficially the same, but authors (c.f. Collins and Collins, 1970; Coulson, 1990 and Soressi, 2004) have asserted that they differ substantially from their Lower Palaeolithic counterparts in manufacture, form and use, raising the possibility that this resurgence in the Late Middle Palaeolithic sees the handaxe performing a substantially different role within the toolkit than before. Lynford, one of the most prolific MTA A sites in Britain, is dated to c.65,000 BP and the handaxes contained within this assemblage have been

noted to show evidence of their use as supports for other tools, for example one handaxe has scraper-like retouch on part of one edge, (White, in Boismier, *in prep*) mirroring observations made by Boeda (1995).

1.2

BACKGROUND TO STUDY

The antiquity of handaxes was first noted over 200 years ago (Frere, 1800) and since then archaeologists have attempted to categorise and explain them. We are now much closer to elucidating the answers to why and how they were made, what they were used for and what they signify about past hominin behaviour. In a British context, several authors have contributed significant leaps forward in the comprehension of these processes, most notably, Roe (1968), Wymer (1968) and more recently McPherron (1995), White (1998a) and Ashton (and White, 2003). The work pioneered by Roe (1968) emphasised the variability present within handaxe-dominated assemblages from the British Lower and Middle Palaeolithic in terms of their metrical attributes, and attempted to place this variation within an objective typological framework. The primary aim of this PhD is to assess the nature of variability in form identified by Roe (1968) and its place within modern handaxe studies and to examine the current theoretical debates concerning the explanation of this variability.

It is now 40 years since the publication of Roe's (1968) seminal research on the categorisation and interpretation of handaxe variability in Britain and it remains the cornerstone of the majority of the studies of British Acheulean assemblages to the present day. Therefore it is not possible to examine the current theories and debates concerning handaxe variability without considering the foundation upon which it is

grounded. Roe (1968) developed a methodology which allowed researchers to place handaxe-dominated assemblages within categories based on an attribute analysis of metrical dimensions such as length, breadth and thickness. The discovery of a bimodal distribution led Roe to divide assemblages into either Pointed or Ovate Traditions, categories based on the relative distance between the butt and the point of maximum width. This thesis considers the formulation and application of Roe's (1968) methodology through the analysis of original data and comparison with Roe's results. It also examines the theoretical context within which the methodology was created and the basis for the terminology utilised. In particular, it examines some of the ways in which one aspect of Roe's metrical analysis has become pivotal in modern handaxe studies, namely the significance of the division of handaxes into Point, Ovate and Cleaver types.

From the analysis of Roe's (1968) metrical methodology it was possible to conduct an objective examination of the key debate concerning the causal factors of handaxe variability, namely resharpening (McPherron, 1995) and raw material constraints (White, 1998a). Both authors conducted their PhD research at the same time and produced markedly different explanations for the bimodal distribution identified by Roe (1968). For White (1998a), building on the work of Ashton and McNabb (1994), raw materials were the primary causal factor, with poor quality or intractably-shaped nodules constraining the form of the handaxe. White also championed the notion of the Ovate form as a preferred form, either through the imposition of a mental template or the notion of the path of least resistance (Gamble, 2001). For McPherron (1995), influenced by the work of Dibble (1987) on Mousterian scraper reduction, the form of handaxes was dictated by the degree of resharpening which had occurred during manufacture and use. McPherron envisaged a sequential reduction scheme

from Pointed to Ovate handaxe. Both authors have returned to this subject in subsequent papers (White and Ashton, 2003; White, 2006; McPherron, 1999; 2000; 2006). Clearly, there is a disparity between these two explanations for variability in handaxe-dominated assemblages which cannot be reconciled and therefore as part of this thesis it is necessary to examine the basis, methodology and results of these theories. This is achieved by applying McPherron's (1995) methodology to my dataset and examining the patterning produced in relation to underlying assumptions inherent in the McPherron model. The issue of raw material constraints is more complicated to assess, as replication of White's (1998a) methodology is difficult to perform objectively. To this end, the thesis progresses with an attempt to avoid the pitfalls identified in the Roe (1968) and McPherron (1995) analysis through the creation of a methodology for recording variability in edge modification.

Through the comparison of handaxes from across the British landscape and throughout the Palaeolithic period, it is possible to look at the wider issues of hominin tool manufacture and use, uncovering the decision-making processes of Palaeolithic hominins and the factors that govern the choices that are made by tool-makers. From this, the counter-arguments which promote cultural factors as more influential than such prosaic causal factors such as raw material or resharpening can be assessed. This section of the analysis focuses primarily on identifying trajectories of resharpening and placing them within the context of a continuum model. The model allows the examination of handaxe types which appear to contradict notions of functional causality, for example twisted-ovates (White, 1998b) and 'extreme' forms (MacRae, 1987, Wenban-Smith, 2004).

From the general outline above, it is possible to identify a set of questions and aims which form the basis of enquiry in this thesis. These are outlined in the following section.

1.3 SCOPE AND PURPOSE OF RESEARCH

The primary concern of this study is the investigation of the nature and causes of handaxe variability in form. The major themes explored in the forthcoming document will examine the causes and factors influencing handaxe manufacture. To facilitate the investigation of this, using a review of current literature and methodologies, the following key questions have been identified:

1. Is there a common causal factor that governs variability in the form of handaxes throughout the British Palaeolithic?
2. Can metrical variability be explained through a single unified approach to handaxe shape?

In order to answer these questions, I have collected original data from a range of sites that represent different aspects of the British Lower and Middle Palaeolithic handaxe spectrum. Amongst these, the key sites of Boxgrove, Lynford, Wolvercote, Cuxton and Pontnewydd provide a solid basis for comparing variability. In the following chapters this data will be subjected to a range of typotechnical and morphometric analyses and compared with existing data. Through this analysis, I will also be attempting to answer the subsidiary question of whether Mousterian handaxes are metrically different from Acheulean handaxes. In doing so it is hoped that the aim of

identifying the causal factors of variability in the form of handaxes in the Lower and Middle Palaeolithic can be achieved.

1.4 JUSTIFICATION OF PROPOSED RESEARCH

The research proposed above can be summarised as encompassing a vast chronological scale, including numerous divisions of the Palaeolithic, at least two different hominin species, three technological complexes and several climatic phases. The geographical scale is narrow, representing only a small percentage of the total geographical spread of handaxe manufacture which is found across five continents (Kelly, 1988 (North America); Gamble and Roebroeks, 1999 (Europe); Davis *et al*, 1999 (Asia); Asfaw *et al*, 1992 (Africa); Holdaway and Stern, 2004 (Australasia)). Criticism could be made on both fronts, both for trying to encompass too wide a timescale and too narrow a geographical area.

I believe that it is entirely justifiable to focus on Britain as a discrete entity in terms of handaxe manufacture. This is not to say that what is happening in Britain is not occurring in other parts of the world, but it cannot be disputed that the British record offers a unique history of colonisation and recolonisation due to its fluctuating status between an island and part of the mainland during the Pleistocene (White and Schreve, 2000). I do not intend to attempt to privilege a British past, but to promote an awareness of the differences encountered when dealing with an area that has a sporadic occupational history (Ashton and Lewis, 2002), is substantially glaciated during most Pleistocene glacial periods (Wymer, 1999) and represents the northernmost reaches of pre-modern human occupation in Europe (Roebroeks and

Kolfschoten, 1995). It is hoped that, in future work, some of the conclusions reached in this study can be compared to other sites across the Palaeolithic spectrum.

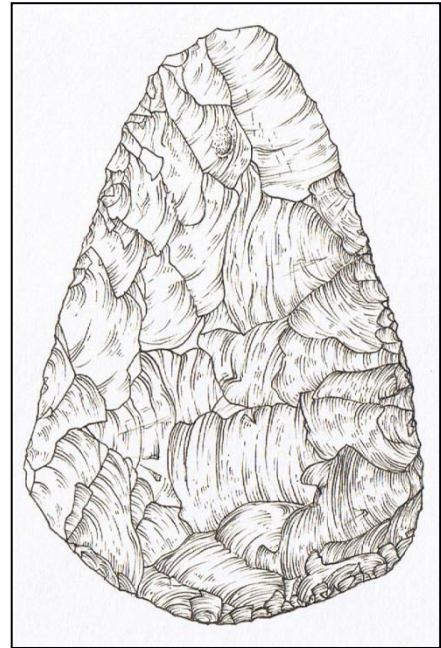
The motivation for the topic of this study arose due to the similarities to Boxgrove handaxes (500,000 BP) noted by the author when excavating handaxes at Lynford (40,000 BP). The underlying question is why Neanderthals start making handaxes again in the late British Middle Palaeolithic? This cannot be addressed without examining handaxes throughout the British Palaeolithic chronology, looking for commonalities that underlie their manufacture and use. In doing so, I am attempting to answer the call of White and Pettitt (1995) to produce a unified approach to lithic analysis that incorporates a research framework for stone tools in the Palaeolithic not restricted to a particular technology. I agree partly with Monnier (2006) that the tripartite division of the Palaeolithic can be a hindrance as it concentrates efforts into compartments of time and space that do not actually exist, whilst focussing attention on searching for transitional technologies. However I do not agree that the answer is to eliminate the current scheme and focus solely on securely dated sites, especially as the predominantly gravel-stratified sites in Britain do not always provide adequate means to date absolutely. Some of the sites used in this study have no dating evidence, yet this should not preclude them from detailed studies, especially where the focus of study is the artefacts themselves, and therefore my approach has been to focus on technological affinity rather than adapt a chrono-centric framework. An approach to lithic analysis which emphasises the validity of the individual artefact as the focus of study is outlined in Chapters 6 and 7, concluding with a new analytical framework for handaxes in which the fluidity of form during handaxe use-life (Shott, 1989) is taken into account. Moving beyond Roe's (1968) paradigm will allow lithic researchers to engage with the processes and rhythms of the Palaeolithic chaîne

opératoire in a way simply unavailable through metrical classification. It also allows the possibility to move beyond deadlock and circular reasoning in modern debates over handaxe form, to engage directly with the processes inherent in the production of the archaeological record.

I believe that a further justification for undertaking this study is timing. It is the 40th anniversary of the publication of Roe's (1968) metrical methodology and in the past decade Roe's classification has become more central to the debate, with increasing effort focussed on comprehensively explaining the variation observed by Roe and his predecessors. This has inevitably led to discussions between researchers with opposing views (c.f. White, 1995; McPherron, 1995). Whilst the debate continues (White, 2006; McPherron, 2006), it is clear that these dichotomous views are unlikely to be the cure-all solution to the debate about variability. It is hoped that by studying these arguments with a view to pairing down the analytical methodologies and conclusions into the basic components, it will be possible to assess the validity of current explanations for handaxe variability from as unbiased viewpoint as possible.

The preceding overview introduced some of the key issues, questions and background to the following study. The issue of variability in handaxes is key to this study and the following chapters will deal primarily with techniques for measuring and explaining variability. The study proceeds firstly by conducting a broad-scale review of research and literature concerning the central issues outlined above. The handaxe as a discrete entity is under particular scrutiny, primarily for its high visibility in the archaeological record. The history of handaxe theory and current ideas are discussed in Chapter 2, and this is used to formulate three hypotheses concerning the controlling factor of variability. Chapter 3 will look in greater detail

at the work of Roe (1968) through background research and detailed examination of his methodology. Chapter 4 identifies the sites used throughout the study and the climatic and environmental context of each. Chapter 5 looks at the application of Roe's (1968) method to some of the collected data and also at the way that resharpening influences the form of handaxes through the analysis and application of the McPherron (1995) hypothesis, examining the basis for his measurements and classifications, putting them to the test against the data generated from the sites in Chapter 4. White's (1998a) hypothesis is also examined in Chapter 3 whilst the notion of prepared form is critiqued in Chapter 7. Chapter 6 also outlines an attempt to classify variability in a new way using edges as a classificatory variable. Chapter 7 takes the results of the edge methodology further and outlines multiple resharpening trajectories which form the core of the continuum model outlined therein. Within the scope of the model, theories concerning the impact of cultural factors on handaxe form are assessed, looking particularly at handaxe types which are asserted to be culturally influenced. This study concludes with the summary of the research undertaken herein and the options for future research.



CHAPTER TWO : THEORETICAL BACKGROUND

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This study is concerned with one central issue: the variation in handaxe form in the British Palaeolithic. One of the aims of this study is to examine the nature of the handaxe production in Britain for the duration of the British Acheulean, in order to see if the superficial similarity in handaxe manufacture can be shown to be masking underlying complexity. It is therefore key to begin by defining both the object and its context.

This chapter concerns the last 150 years of research into the Palaeolithic of Britain and its primary focus, the handaxe. The following is a preview of the range of issues covered in the following chapters, together with a summary of the theoretical background to date. This is presented thematically rather than chronologically, through a discursive format covering the most pertinent issues surrounding this topic.

‘The Palaeolithic of Europe is a record of observations and a register of ideas.’
(Gamble, 1999).

One of the first things to define in this study is the context surrounding the production of handaxes. At its widest point this refers to the timeframe within which handaxes are produced, utilised and discarded, namely the Palaeolithic, and more specifically the Lower and Middle Palaeolithic. The Palaeolithic begins with the appearance of stone tools approximately 2.6M BP (Semaw *et al*, 2003) and ends approximately 10,000 BP, with the start of the Mesolithic (Wymer, 1999). The term

Palaeolithic literally translates from Greek as ‘Old Age of the Stone’ and was coined by Lubbock (1865) as the time ‘*when man shared the possession of Europe with the Mammoth...The epoch is characterized by flint implements of the rudest type*’ (Encyclopaedia Britannica, 1911).

The Palaeolithic can be further subdivided, dependent on which region of the world is being related to, hence the Early, Middle and Late Stone Ages of Africa. With regards to Britain and Europe the scheme of Lower, Middle and Upper Palaeolithic is used, but can be altered chronologically to reflect the particular history of a specific region. For instance, the Lower Palaeolithic in Britain at present extends to 600kya, with the first appearance of hominin artefacts (Parfitt *et al*, 2005). For the purposes of this study, the period between 500,000 BP and 40,000 BP is divided into five Palaeolithic sub-stages to reflect both the accepted British standardised chronology (Wymer, 1999) and the technological changes taking place. This negates the problems envisaged by Monnier (2006) who rightly criticises the basis of the division between Lower and Middle Palaeolithic, but fails to realise the benefits of using an explicit and defined regional chronological framework. The details of this are outlined in Chapter 4. Having defined the context of handaxe manufacture, it is now important to define the object of study itself.

2.3

DEFINING THE HANDAXE

The hardest part of any discussion about handaxes is to try and succinctly describe exactly what one is. Definitions often broadly encompass several aspects of handaxes: their context, function, mode of manufacture and their symbolic nature.

The term handaxe itself, replaced by the less loaded term *biface* in American and French literature, offers connotations of function and mode of use. The examples below typify some of the ways handaxes are defined within academic literature:

Functional: *The Acheulean hand-axe... was an all-purpose tool, slim enough to easily fit into the hand* (Clark, 1969).

'...handaxes that served, like Swiss Army knives, as multi-purpose tools, and were undoubtedly essential in chopping meat into small pieces.' (Bar-Yosef, 2006, 490).

Mode of Manufacture: *'In general, a handaxe is a flake or core blank that has been reduced on both faces from two parallel but opposing axes through percussion'* (Kelly, 1988, 718).

'A tool that has two surfaces that meet to form a single edge that circumscribes the tool. Both faces usually contain flake scars that travel at least halfway across the face.' (Andrefsky, 1998, xxi).

Contextual: *'An individual handaxe... is the outcome of one or more particular and purposeful acts perpetrated by one or more knowledgeable agents in specific social and material circumstances.'* (Hopkinson and White, 2005, 21).

Symbolism: *'The symmetry of many hand-axes is often exaggerated beyond any possible benefit it could give the tools and can perhaps be interpreted as the beginnings of an aesthetic sense.'* (Wymer, 1968, 47).

Many papers do not provide an explicit definition of a handaxe or biface, instead relying on a familiarity on the part of the reader with the terminology and meaning inherent within it. For a more comprehensive definition of the history and derivation of the term '*handaxe*' and its meaning see Dibble and Debenath (1995, 130) whose description is too lengthy to reproduce here. They see handaxes as metrically and typologically defined entities and discuss the mode of manufacture commonly used

to create them. They also stress the potential variation within a general format, particularly the extent of bifacial working.

This concept of variability is important to any concept of handaxe definition. Handaxe shape varies enormously, and is often typified by certain classic examples which are demonstrated to support a broadly ‘pear-shaped’ or ‘tear-drop’ profile. This is perhaps why many papers concerning handaxes utilise metrical means of distinguishing between handaxes (cf. Roe, 1968; Wymer, 1968; Gowlett and Crompton, 1994; White, 1995; McPherron, 1995). As seen above, it is possible to imbue handaxe shape with symbolism, or to reduce a definition of a handaxe down to a method of manufacture. An individual handaxe can be described by virtue of its shape, size, raw material type or method of reduction without straying too far from the facts. Positing method of use, function or symbolic content is more fraught with difficulties. It is also possible to generalise in terms of form on a regional scale (Wynn and Tierson, 1990) but it should be realised that the larger the scale utilised, the greater the potential to mask underlying differences (Hodder, 1991).

So far, a handaxe is reduced to a technical definition of a unifacially or bifacially-worked stone tool (although see Villa and D’Errico (2001) for examples of bone handaxes), of varying shape and size, with numerous possible uses and a probable symbolic component. It may not be possible to define a handaxe in a more specific way, and neither may it be desirable. Wymer (1982) referred to the handaxe as an enigma, but Gamble and Porr (2005) see the primary context, humanly-made handaxe as offering an unparalleled insight into the activity of ancient hominins. Since the very first identification of handaxes as humanly-made objects, authors have

attempted to access information about handaxes through aspects of morphology and context.

2.4 THE HISTORY OF HANDAXE RESEARCH

Summaries of the history of Palaeolithic research are a mainstay in the introductions of most syntheses of the subject (c.f. Wymer, 1968; White, 1995). Although the evolution of ideas concerning the nature, origin and meaning of bifacial technology are essential to understanding the current state of handaxe research, it is neither possible nor necessary to elaborate in great detail here (for a good summary of the early history of lithic classification see Monnier, 2006 or Stringer, 2006). What follows is a summary of the major events and themes in the history of handaxe study.

From the Temple of Apollo over two millennia ago, to the more modern era of bible-centric Creationist ‘science’ the presence of handaxes was conventionally explained as the physical manifestation of thunderbolts. In Ancient Greece, these were attributed to the gods (Montelius, 1910), and later on to nature, fitting into the notion that the world had existed since its Creation by God, in 4004 BC. The identification of them as humanly-made objects of great antiquity was made, if not accepted, in the latter years of the C18th by John Frere, an antiquarian, at the now-famous site of Hoxne (Frere, 1800). It took over 50 years for the discovery to be verified, in a new climate of scientific discovery and acceptance of the antiquity of the Earth, fuelled by the works of Lyell (1863) and Darwin (1859) amongst others. The work of Boucher de Perthes (1847) on the handaxes of the Somme Valley was also a great influence on the identification of artefacts of great antiquity.

With handaxes accepted as ancient artefacts, classification began in earnest (de Mortillet, 1869; Evans, 1897; Breuil, 1932). A chronology of lithic artefacts assigned ‘cultures’ to groups of lithic artefacts in the following way: pre-Chellean (for pebble tools), Chellean/Abbevillian (crudely manufactured handaxes, hard hammer percussion) Acheulean (well-made handaxes, soft-hammer finished), Micoquian (advanced Acheulean) and Mousterian (developed from the Clactonian flake-tool tradition). Other non-handaxe-based industries such as the Clactonian and Levalloisian were also identified. These categories were seen in a strictly chronological progression with increasing sophistication (Oakley, 1958).

Throughout the C19th and into the C20th, the study of handaxes continued, as emphasised by the depth of research summarised in Chapter 4. New sites were discovered, and increasing volumes of lithic artefacts were available for study. Subjective ‘culture-historical’ typologies began to be superseded by more objective morphometric ones. Notable amongst these is Francois Bordes’ (1961) typology for the Lower and Middle Palaeolithic. Bordes refined the notion of measuring variability in handaxes by a series of measurements and formulae. He categorised handaxes using measures of shape and size, and his work is the basis upon which many subsequent typologies were created. With regards to British research, the most notable contributions were also made on the subject of refining classification. Roe (1964) and Wymer (1968) almost simultaneously developed schema for classifying handaxes, the former based on metrical measurements, the latter on a mixture of visual observation, measurement and attribute assignment. Many subsequent studies have built on the ideas and methodologies suggested by these two authors, whilst others attempted to create new typo-technical methodologies (cf. Cranshaw, 1983) or to apply different statistical tests to the original data (Graham, 1970). Regardless of

this, the majority of studies conducted into British handaxe assemblages utilise the standard measurements outlines by Roe (1968) for the sake of comparability with other research. Both the Roe (1968) and Wymer (1968) methodologies will be discussed in more detail later in this chapter, with particular reference to debates leading directly from Roe (1968) that have dominated the academic landscape of handaxe study over the past decade (White, 1998a; McPherron, 1995).

Other important approaches to the study of handaxes over the past 30 years are also outlined in greater detail below. These include the explanation of handaxe variability through the allometric relationship of size and shape (Crompton and Gowlett, 1993; 1994) and the recognition of fluidity in tool forms relating to Mousterian assemblages (Dibble, 1987; Boeda, 1995). Increasingly in the current decade, the emphasis is changing towards seeing handaxes as products of the individual (Gamble and Porr, 2005) and as cultural objects (Wenban-Smith, 2004) imbued with semiotic meaning (Pope, Russell and Watson, 2006). These are all important concepts to comprehend in the examination of the causes of handaxe variability. Firstly though, it is useful to examine the current state of knowledge concerning handaxes in the British Acheulean and Mousterian.

2.4.1 HANDAXES IN THE BRITISH ACHEULEAN

‘For about 500,000 years, that is, for most of the time that man is known to have existed, progress was very, very slow’ (Copley, 1955, 15).

‘...the fabrication of handaxes, and the flexible responses to raw material constraints that generate their morphological variability, persist apparently unchanged through an immense period of time’ (Hopkinson and White, 2005, 23).

The Acheulean has suffered for many years with an image crisis (Gamble and Porr, 2005). Handaxes are some of the earliest, readily recognisable human-made objects in the archaeological record. But therein lies the problem, they appear ubiquitous, are found in deposits aging from 1.5mya to 40kya and the Acheulean ‘culture’ (Goren-Inbar and Sharon, 2006) stretches across a vast geographical area from Africa to China, sporadically crossing the ‘Movius Line’ (Movius, 1948) that had previously demarcated handaxe-making populations. The Lower and Middle Palaeolithic periods have previously been characterised as having a lack of innovation, a consistency in human behavioural patterns and were seen to lack cultural signatures (Clarke, 1951; Isaac, 1977). By comparison to the modern age, or even the more recent past, more than a million years of hominin existence appears to lack lithic ‘evolution’. Gowlett (1998) observed that a perceived similarity in handaxes from sites separated chronologically by half a millennia was complemented by handaxe assemblages in the same period and region which were markedly different. The title of this section refers to the British Acheulean, however some of the issues discussed below relate to the Acheulean as a whole. It is not possible, or necessary, to cover all the pertinent issues relating to the entire geographical scope of the Acheulean technological complex. Since the research of Wynn and Tierson (1990) it has been recognised that regionality does exist within the Acheulean and therefore it is justifiable to focus upon a single region.

Commonly, the Acheulean is defined by the presence of ‘*bifacially worked stone tools, of which handaxes and cleavers are the hallmarks*’ (Goren-Inbar and Sharon, 2006, 1). Acheulean technology contains a wide range of ancillary tool types made from flakes (Gamble, 1986) and is representative of a *façonnage* style of reduction, where the nodule or flake being worked upon is progressively reduced into a final

form. The desired component of *façonnage* tool manufacture is believed to be the core piece, with the *debitage* being waste material. Pettitt (*unpublished*) argues for *façonnage* technology being representative of low raw material conservation whereas Kelly (1988) believes that handaxes perform raw material conservation perfectly as they allow a generalised form that can be resharpened to extend the use-life, retouched to make a new form of tool, provide a durable cutting edge and allow for the removal of sharp flakes with a sharp cutting edge.

Hominin presence in Britain is evidenced at Pakefield in the form of flint flakes and animal bones, estimated to be approximately 700,000 years old, at a time when Britain was connected to Continental Europe (Roebroeks, 2005) but there is no indication that this is representative of classic Acheulean material as handaxes are absent. It is fair to say, that at this point, Boxgrove represents the commencement of a substantial Acheulean-making hominin presence in Britain. European Acheulean assemblages are found until approximately 250,000 BP (Goren-Inbar and Sharon, 2006) when the spread of Levallois occurs, yet Late Acheulean type assemblages in Britain persist into the Middle Palaeolithic into MIS 7 (230,000-180,000 BP) at Pontnewydd (Green *et al*, 1987) and Great Pan Farm (Poole, 1925) amongst others.

The Acheulean in Britain encompasses a myriad of different forms of handaxe. Boxgrove handaxes are typically thin, with soft hammer, invasive flaking and tranchet removals (Roberts and Parfitt, 1999). Handaxes from High Lodge are all finished with soft hammers with frequent cortex retention. A small percentage (8%) of them are made on flakes, with a quarter of all handaxes exhibiting a tranchet removal (Ashton, 1992). Twisted handaxes are a feature particularly of the Hitchin, Elveden and Bowman's Lodge assemblages (White, 1998b). Handaxes from Stanton

Harcourt and Pontnewydd are predominantly manufactured on non-flint raw material (MacRae, 1991; Green, 1984). Non-local stone is rare on European Lower Palaeolithic sites, especially in Southern Britain, but there is no clear cut preference for the manufacture of handaxes on either good or poor quality stone (Bosinski, 1996).

Due to issues of isolation and recolonisation (White and Schreve, 2000), it is not possible to demonstrate a continuity of lithic manufacture through the British Lower and Middle Palaeolithic. However, it seems that handaxe-dominated assemblages become subsumed by Levallois-dominated assemblages lacking in handaxes from MIS 8. The origins of prepared core technology in Britain are seen in a proto-Levallois complex, dated to MIS 9/8 from Purfleet (White and Ashton, 2003). Levallois and Acheulean technology co-exists in separate assemblages (White, Scott and Ashton, 2006) in MIS 8 and 7. In some areas of Europe, handaxes cease to be manufactured (Goren-Inbar and Belfer-Cohen, 1994) and in others handaxes increase and diversify in manufacturing technique and function (White and Ashton, 2003). From a British perspective, following the population-free MIS 5e, the hominins that return in MIS 4 manufacture predominantly handaxes within a Mousterian technocomplex which is lacking in substantial quantities of Levallois (Wymer, 1999).

2.4.2 HANDAXES IN THE BRITISH MOUSTERIAN

No overview of the Mousterian techno-complex in Britain would be meaningful without first giving reference to the Mousterian as a whole. The Mousterian is

characterised by a specialisation in regular and standardised tool forms, which exhibit a range of scraper forms and a general lack of handaxes (Roe, 1981). Bordes (1961) was the first to classify the Mousterian into several different sub-industries, namely Mousterian of Acheulean Tradition (MTA) (Types A and B), Typical Mousterian, Denticulate Mousterian and Quina Mousterian. These types are all defined by the differing frequencies of tool types contained within them (Bordes, 1961). Debate has since ensued over the validity of these tool types on typological grounds (Dibble, 1987) and on cultural (Bordes, 1953) versus functional grounds (Binford, 1989) until Mellars (1996) provided good stratigraphic data that showed the clear separation of the MTA industries chronologically. Noble and Davidson (1996) argue along a similar line to Binford (1989) that variation in Mousterian types is representative of planning in tool production and instead feel that it represents adjustments to local circumstances. There are now recognised to be regionally distinct groupings of MTA assemblages which all have a key bifacial type. This includes triangular handaxes in Northern France, cleavers in Brittany, cordiforms in south-west France and bout coupé handaxes in Britain (see below) (Soressi, 2004). The reasons for this regional distribution are unfortunately beyond the scope of this study.

The Mousterian in Britain is confined to MTA A (Coulson, 1986; Roe, 1981). There are, so far, no excavated assemblages of Type B MTA. Bordes (1961) defines MTA typologically as containing the following proportions of tool types:

	Handaxes	Scrapers	Denticulates	Other
MTA A	8-40% triangular and cordiform	20-40%	10-15%	Points and backed knives. Blades, burins and borers (Upper Palaeolithic type)
MTA B	4-5% no triangular	4-10%	25% +	20% + backed knives. Laminar retouched bladelets.

Table 2. 1 : Features of MTA technology. After Bordes (1961).

This is in comparison to the other Mousterian industries:

	Handaxes	Scrapers	Denticulates	Other
Typical	Absent	22-55%	Present	Notched tools, points and backed knives.
Denticulate	Absent	3-7%	80% (inc. notches)	Burins and scrapers.
Quina	Few or absent	75% + (side scrapers)	Present	Quina scrapers, burins, end scrapers and borers.

Table 2. 2: Features of Mousterian technology. After Bordes (1961).

MTA assemblages in south-western France are found at the top of the chronological sequence and the distribution of MTA is restricted to the extreme north-western areas of Europe, namely the south-west and north-west of France and Britain (Soressi, 2002). When examining the MTA sites in south-west France, Soressi (2004) describes MTA handaxes as '*finely retouched convergent scrapers on bifacially shaped blanks*' (pp 346) and she documents that thicker flakes were produced for other purposes than those used to make handaxes. She distinguished between the edges converging on the tip (active) and the basal edge (passive) in terms of activity. Use-wear analysis indicated that MTA handaxes were being used for scraping hide and wood and butchering meat (Soressi and Hays, 2003) and formed part of a toolkit of multifunctional tool types. Soressi (2002) sees the lack of handaxes in the MTA B as a reflection of a lack of need for a resharpenable tool. When examining the soft-hammer flakes from handaxe manufacture at Pech-de-l'Azé I, 14% showed retouch on the dorsal side indicating resharpening was taking place.

The Mousterian in Britain is characterised by a particular form of handaxe. The bout coupé handaxe is geographically restricted to Britain and Northern France, and forms a large part of Mousterian-age assemblages in Britain. The bout coupé falls outside

of the Acheulean range of handaxes and exhibits a strong element of prepared core technique, with well made flake tools (Roe, 1981). Shackley (1977) notes that they are often made on flakes and are characteristically thin and well refined. Bout coupés from Coygan Cave have fine bifacial finishing to the butt and dominate the assemblage numerically (Aldhouse-Green *et al*, 1995). Parallel bifacial retouch to the butt and fine marginal retouch to one face are seen on most bout coupé handaxes and are construed as a form of resharpening (White and Jacobi, 2002). The situation is similar at Oldbury (Collins and Collins, 1970) where the bifacial element predominates, although retouched flake tools outnumber handaxes 6:2. Flake debitage at Oldbury is almost all from handaxe manufacture (Collins and Collins, 1970). The MTA is seen as descending from the Acheulean typologically, although an actual continuity is highly unlikely given the temporal gap between the two (Tuffreau, 1982). Sites are concentrated in the South and East of England (Aldhouse Green *et al*, 1995), and around water sources, with isolated finds occurring elsewhere representative of hominin hunting ranges (Shackley, 1977). MTA A sites in Britain are found both in the open and in caves. Those that can be conclusively dated are all of Middle Devensian date (60-40,000 BP) compared with 55-48,000 BP in France (Aldhouse-Green *et al*, 1995). Assemblages are characterised by non-laminar debitage, a lack of cores and a limited Levallois component. The lack of Levallois was suggested to be due to a lack of flint, but this has to be discounted as many of the sites where MTA is found have abundant raw materials. Coulson (1990) notes that there are many similarities between British and French MTA sites, although the latter have a larger Levallois component. None of the sites show a long occupational history. Another observation that has been made of bout coupé handaxes is that the classic shape may be as a result of intensive resharpening (Tyldesley, 1987) and there is new data which suggests a continuum of handaxe to scraper morphology

which may indicate a high level of resharpening in line with the notion of a flexible design (White, in W.A.Boismier, *in prep*).

Tyldesley (1987) describes a bout coupé handaxe as:

‘A refined and fully bifacial medium-sized cordiform or rectangular handaxe with a symmetrical planform, having a straight or slightly convex butt edge, slightly convex sides and a rounded tip, and showing a marked discontinuity of curvature at the intersection of the sides and the base. Both the butt and the tip are well worked, frequently with delicate soft-hammer removals, and there are no large unworked areas or cortex patches. The cutting edge runs right round the circumference of the piece and is straight or only slightly twisted; tranchet scars may or may not be present at the tip’ (Tyldesley, 1987, 155).

This definition, whilst substantially more specific than previous definitions (c.f. Roe, 1981; Shackley, 1977) is still one that is open to criticism (Coulson, 1990). What is most problematic is the usage of this defined type to assign a site to a specific period, where the discovery of a bout coupé handaxe must equal a Middle Devensian Neanderthal site. In their study of bout coupé handaxes, White and Jacobi (2002) conclude that the bout coupé handaxe *‘cannot be regarded as an unequivocal marker for the Mousterian’* (White and Jacobi, 2002, 109) although they do recognise that a temporally and geographically restricted bout coupé phenomenon occurs in Britain at approximately 59-41 kya (MIS 3).

There is no doubt that handaxe-making individuals do return to Britain in this period, and, it looks increasingly likely, earlier, in MIS 4 (W.A. Boismier, *in prep*). What is unclear, and infrequently considered, is why there is a return to handaxe making at this time. Are these new handaxes quantitatively and qualitatively different in any way? What do the similarities and differences between the Acheulean and Mousterian tell us about the tool-making behaviour of hominins? What internal and

external factors influence this behaviour? Some of these questions are addressed through the data analysis and interpretation later in Chapters 5-7.

Having discussed the technological signature of this period, it is now necessary to look more closely at the hominin groups that are responsible for producing the signature. Recent research has highlighted the lack of emphasis on the individual in Palaeolithic studies (Gamble and Porr, 2005) with many studies almost giving life to the artefact itself. The following section discusses the current theories concerning the capacities and dynamics of ancient hominin groups and individuals.

2.5 ANCIENT HUMANITY IN A ‘CULTURAL ENVIRONMENT’

‘He was shorter than the average Englishman of today. He stood with knees bent, his body stooping...He had bushy eyebrows sprouting above his low brows... he was not the sort of man we should care to meet in a lonely spot.’ (Hall on Neanderthals, in Wimbolt, 1945).

The term ‘cultural environment’ (Mania and Mania, 2005) is used here to represent the behavioural capacity of hominins expressed in the archaeological record in the form of decision-making events. It also includes the physical and mental limitations imposed by the structure of the body and brain. Cultural environment combines the social and personal aspects of hominins that influence their behaviour. The following is a discussion of the aspects of the Lower and Middle Palaeolithic’s cultural environment as recognised through artefactual remains and the implications for the mental, physical and behavioural status of *H.heidelbergensis* and *H.neanderthalensis*.

H.heidelbergensis fossils are found across a wide geographical range (Rightmire, 2007) encompassing Africa, Asia and Europe. Whilst debate still continues as to whether all of these specimens constitute a single lineage (Harvati, 2007), morphologically, *H.heidelbergensis* seems to bridge the gap between earlier *H.erectus* fossils and morphologically more modern *H.neandethalensis* and *H.sapiens*. This is evidenced in a generally robust physiognomy echoing earlier traits, combined with brow, nasal and palate architecture more congruent with later hominins (Rightmire, 2004). Much of the literature concerning *H.heidelbergensis* is concentrated on the clade-based characteristics of the species and its place within the human phylogenetic schema. There is also an emphasis on the increased encephalisation present in *H.heidelbergensis* specimens and the connection with more sophisticated stone tools and hunting strategies seen in the archaeological record.

When reviewing literature concerning Neanderthals, it is evident that there has been a large amount of concentration on the later stages of Neanderthal existence. Two of the most recent monographs on Neanderthals in Europe are devoted exclusively to the study of the last vestiges of Neanderthal occupation (Stringer *et al*, 2000; van Andel and Davies, 2003). Searches of scholarly output reveal two current interests; Neanderthal extinction and Neanderthal DNA. The former has long been a popular subject for scholarly debate, the latter is a relatively new endeavour, being made possible by recent scientific advances. Both of these investigations are valid and interesting, but do lead to a scarcity of debate regarding the long period of prehistory when Neanderthals and their predecessors, *Homo heidelbergensis* existed before the incursion of modern humans into Europe. There is no need for the examination of *Homo neanderthalensis* in this context to become embroiled in debates concerning

the timing of Neanderthal extinction (Mellars, 2006; Finlayson *et al*, 2006) or Neanderthal/modern human interbreeding (Duarte *et al*, 1999; Jones, 2007). The most important area for discussion in relation to the use of stone tools by hominins is the theory that concerns the lifecycles of Lower and Middle Palaeolithic hominin groups. How mobile were they? What resources did they exploit? What does their physiology suggest about their life? What was their level of interaction with the environment? All of these questions allow for tool manufacture and use to be fitted into the wider context of hominin existence. Many statements below apply equally to *Homo heidelbergensis* and *Homo neanderthalensis*, and in many cases there is no appreciable difference made between the two. In the case of stone tools, it may be a case of dividing between Acheulean and Levallois/Mousterian sites. The following is a summary of the available material concerning the cultural environment of hominins between 500,000 BP and 40,000 BP.

Despite the inherent difficulties in dividing between hominin species, between key tool types and placing a line between the Lower and Middle Palaeolithic (Monnier, 2006) it remains that most studies do exactly that. Binford (1989) classifies some behavioural differences related to cultural capacity between the Lower and Middle Palaeolithic. These are summarised below:

Lower Palaeolithic	Middle Palaeolithic
No evidence for planned occupation	Increase in the complexity within assemblages
No organisation of space	Patterning in space
<i>'Technology an aid to adaptation not a means'</i>	Change in the role of technology
Handaxes and cleavers transported	No evidence of 'culture'
Expedient use of faunal resources – transport of lower limbs and head	Still limited planning and tactical depth
Palimpsest and episodic occupational horizons	

Lower Palaeolithic	Middle Palaeolithic
Sites represent places where tools are used to interact with the environment	
Tethering of hominins to raw material sources	
Similarity of stone tools suggests no culture	

Table 2. 3: Differences between Lower and Middle Palaeolithic hominins. Adapted from Binford (1989).

The list above is by no means convincing. Indeed, Gamble (1999) suggests considering the Middle Pleistocene as a whole and so encompasses all of the Lower and some of the Middle Palaeolithic, but not the Late Pleistocene period of the Mousterian. For Gamble, Middle Pleistocene hominin behaviour can be characterised by a lack of long-term occupation, suggested by episodically used locales and variable situational behaviour (Gamble, 1999). ‘*Short-term, episodic and highly mobile*’ (Roebroeks and Tuffreau, 1999, 129) characterises the spatial behaviour of Middle Palaeolithic hominins. Kolen (1999) studied the nature of Middle Palaeolithic settlement and could not identify any ‘home bases’ or constructed dwellings, concluding that fixed locales where hunting parties would foray from were not a part of a more nomadic, resource-led Neanderthal scheme. As such, this categorises Middle Palaeolithic hominins as having a strategy of niche geography, moving around the landscape to the places where resources are to be found. She sees a difference in the late Middle Palaeolithic with the use of specialised locations in the landscape by Neanderthals (Kolen, 1996). Hominins favoured sites near to water sources (see Chapter 4 for examples), not only for water but also flint, game and ease of movement away from forested zones (Wymer, 1982). Some sites have occupation in the same place through different climatic phases which suggests that, for these locales, climate was not the prevailing influence on behavioural patterns (Gamble, 1996). From the sites that have been excavated so far, European Middle Palaeolithic

hominins seem to have lived in a whole range of environments (Roebroeks and Tuffreau, 1999) although they are conspicuously absent from areas experiencing very cold or very dry climates (Mithen, 1996). This suggests a limitation in either technological or conceptual adaptive behaviour (Barham, 2000).

The use of local raw material is common to both the Lower and Middle Palaeolithic periods, as are repeated visits to locales over thousands of years. Transport of raw materials over long distances only occurs in areas with low raw material resources, with tools being the only materials routinely transported around the landscape (Feblot-Augustins, 1999). Transport in the Lower Palaeolithic rarely exceeds 60km whereas the Middle Palaeolithic, transport can occur over 100km. Patterns of raw material transport in the Middle Palaeolithic are the same in places with different resource availability, topography and terrain suggesting that these factors are non-contributory. Therefore different strategies of raw material procurement could relate to differences in conceptual capabilities, technology or environment (Feblot-Augustins, 1993).

Gamble (1999) suggests that throughout the Lower and Middle Palaeolithic there must have been limited social cooperation with a local social life and no long-distance connections through trade. Socially, care of elderly and disabled members of the community suggests a high level of social interaction with individuals valued for more than hunting skill. The evidence for intentional burial is undisputable, though whether this was social or functional is not clear. There is a distinct lack of personal adornment which appears to substantiate the separation of social and technical knowledge (Mithen, 1996b).

H.heidelbergensis and *H.neanderthalensis* were reliant on game for food, combining proficient hunting with opportunistic scavenging. This required a sophisticated level of knowledge about animal behaviour and the landscape. They both lived in medium to large groups to maximise hunting success and to utilise large kills efficiently (Mithen, 1996b). Gaudzinski (1999) sees a change in faunal exploitation strategy at MIS 7 where it appears that hunting becomes a large part of the standard repertoire. This is substantiated on the basis of single species faunal assemblages, which indicate intentional and focussed hunting strategies, with meat processing occurring in a standardised fashion. Before MIS 7, faunal exploitation is representative of less regular and smaller scale hunting events.

Morphologically, Neanderthals are seen as being well adapted to cold environments, with a high degree of skeletal robusticity and shorter forelimbs. In combination with high dental attrition, this suggests a highly physical lifestyle with the teeth being used for non-masticatory functions such as holding hides for scraping (Kuhn, 1995) and is supported by the high level of stress fractures and degenerative diseases evident on Neanderthal skeletons (Conard, 2001). Brain size comparisons show a rise in capacity from 970-1200cc (*H.erectus*-*H.heidelbergensis*) (Harvati, 2007) to 1200-1750cc (*H. neanderthalensis*) (Stringer and Gamble, 1993). Mithen (1996) states that this should not be seen as a gradual increase, citing 500,000 BP as the point when social intelligence and language capacity increase significantly taking brain capacity much higher. This, being close to the first occupation of Europe by *H.heidelbergensis*, may have significant implications for the nature of colonisation. Harvati (2007) notes that the increased encephalisation occurring within *H.heidelbergensis* populations cannot be attributed to increased body size alone and

instead should be linked to increasing technological sophistication and increased hunting skills and knowledge.

Despite the recognition of the Neanderthal and her ancestors as innovative, active participants in their own existence, it still remains that the lithic signature of ancient hominins appears, at least on the surface, to be static and unchanging for a great deal of this time span (Wynn and Tierson, 1990). As such, it is important to examine the research surrounding the manufacture and use of handaxes during this period.

2.6

HANDAXES IN ACTION

Handaxes represent a relatively high investment of time and energy and therefore are not produced to be discarded (Kelly, 1988). Mithen (1996b) states that the investment of energy and time in the creation of a handaxe is difficult to explain in purely functional terms. Handaxes represent high levels of knapping skill with long and complicated procedural templates that could not be learned by trial and error. They represent enhanced social learning in large groups (Noble and Davidson, 1996).

Handaxes are most commonly associated with butchery (Jones, 1980) but Wymer (1982) notes that previous and subsequent industries without handaxes also exploit big game so it is unlikely that handaxes are a superior butchery tool. They do not appear to have ever been hafted, and would not have proved useful in close range hunting. Acheulean toolkits also contain cleavers that may have provided woodworking and plant processing capabilities, although these are a more important component of the African Acheulean (Wymer, 1982; Roe, 2001). Acheulean activities, as indicated by microwear, include meat cutting, hide scraping and wood

working, mostly using unretouched flakes (Wymer, 1982). Handaxes are better for butchering animals than unretouched flakes (Jones, 1980) due to their superior weight and ease of handheld use. Jones found that handaxes were most effective for the butchery of large game.

Keeley (1980) conducted microwear studies on stone tools, but was only able to examine a few handaxes due to their size. Those that were examined had traces of meat cutting residue, which was also found on flakes, suggesting an overlap in the function of flakes and handaxes. Keeley sees certain bifacial types as specialised, but the majority of shapes are not used for specific functions. He believes that handaxes in the Acheulean were made to be taken on expeditions, whereas flakes were used at base camp. This may have meant handaxes were abandoned at kill sites in order that more meat could be carried (Keeley, 1980).

Handaxes are also in action within and between sites. Research at Boxgrove (Pope and Roberts, 2005) revealed that knapping scatters and the handaxes produced from them were rarely found together, indicating movement of handaxes within the site and also within the landscape. There was also a differential discard behaviour evidenced at the single episode butchery site (GTP17) and the habitually visited Q1/B. Handaxes were manufactured at GTP17 but all were removed from the site whereas large numbers of handaxes were discarded around freshwater locations in Q1/B. This indicates a complex route from manufacture to use to discard which may not be completely represented at any one location.

Lithic production is by nature conservative and changes generally reflect increases in efficiency. Handaxes represent a means to counter variation in raw material

availability. When there is a surplus of raw materials, the emphasis on efficiency is likely to be decreased. Variability in manufacturing techniques is more likely amongst larger groups, as smaller groups have less potential for innovation and are slower to accept new innovations, making it more difficult to introduce new variants (Mithen, 1994; Barton, 1997). Variation can be as a result of individual choice, but this is more likely a result of use and maintenance (Dibble and Rolland, 1992).

The above discussion briefly summarises the ways in which handaxes are used by active participants in the landscape. The discussion indicated that handaxes are not static objects and may contain information about the hominin behaviour that produced them. It is also possible that the environment and functional applications of stone tools have a large influence on the creation of variation in bifacial assemblages. Earlier in this chapter, the typological and metrical schemes for categorising variability were mentioned. The following section expands on this in detail, discussing the ways in which variability can be categorised.

2.7

CATEGORISING VARIABILITY

The preceding discussion has explored the definition of a handaxe and summarised a brief history of handaxe research, through which some of the ways of categorising handaxes have been mentioned. There are multiple ways of categorising handaxes, most of which are in essence documenting variability as they classify types based on form. As mentioned earlier, types can be defined visually, such as the *bout coupé*, as defined above as a combination of form, manufacturing methods and the presence or absence of defined features. Visual typologies however are often open to subjectivity as they rely heavily on the interpretation of the researcher. Another method for

categorising variability is to use metrical criteria to define types, ostensibly with the aim of removing subjectivity by using calculations and ratios in the place of judgement and perception. The discussion in this section briefly examines two of the key schemes used to categorise variability by British lithic researchers in the latter half of the twentieth century. A more in-depth discussion and examination of the inherent advantages and disadvantages of these methods is the subject of Chapter 3.

The major scheme utilised by British lithic researchers to categorise handaxe assemblage is Roe's (1964; 1967; 1968) metrical methodology, which was devised with the aim of producing an objective typology (1964, 266) for comparing handaxe assemblages from the British Lower and Middle Palaeolithic. His research was undoubtedly concerned with proving metrically that cultural stages and groups existed, demonstrating a typological chronology of cruder to more refined forms. To this end, Roe (1968) selected 38 sites on the basis of chronology and typology, rejecting sites that did not have a substantial amount of implements or that had a lack of demonstrable assemblage cohesion.

Handaxes from each of these sites were measured along several axes combining the traditional measures of maximum length (L), maximum width (B), and maximum thickness (Th), with measurements such as distance from the butt to the point of maximum width (L_1). The purpose of these was to define the size, shape and refinement of the handaxes, seen as key to dividing assemblages into 'Traditions'. Roe (1964) acknowledged that the measurements defining size, namely weight, length, breadth and thickness, can be linked to raw materials and functional constraints as well as being a product of cultural choice. Despite this, he claimed that

a notion of preferred shape could be seen by examining the various ratios of these measurements.

In Roe's (1968) scheme, each handaxe was a Point, an Ovate or a Cleaver based on the relative distance of the point of maximum width to the butt (L_1). Each of the sites he studied was examined, and considered to be dominated by a particular shape if there were more than 60% of that type in the assemblage. Although it was possible that there could be Cleaver-dominated assemblages, none were found. Having identified assemblages as either Point-dominant; Ovate-dominant; Uncommitted (Ovate or Point) or simply Uncommitted, Roe took this further by looking at other features such as the presence/absence of tranchet sharpening and plano-convexity to group all the sites into 'Traditions'. From this he tentatively interpreted that a cultural or chronological pattern was possibly responsible for the groupings, acknowledging that stricter chronological controls were necessary to confirm this.

As a result of this assignment of 'Traditions', the majority of subsequent debates on bifacial variation have hinged on the identification of these two main categories of handaxes within British assemblages (Points versus Ovates), and the reasoning behind the patterning.

Wymer (1968) published an exceptional account of the sites and collections available for study from the Lower Palaeolithic of the Thames Valley. As a preface to this, he examined the origins of the different terminologies and typologies that were the common way of describing stone tools of this period. Wymer recognised that the assignment of typological categories to handaxes such as Point, Ovate and Cleaver had the ability to subsume variation and obscure distinctive forms. He also realised

that the grading of types left those on the boundary between two types almost impossible to categorise. To this end, Wymer (1968) outlined an extension to the typology of Point Ovate and Cleaver using a combination of letters and Roman numerals to indicate at once overall type and subtype. He recognised that, although the scheme did allow for a more fine-grained attribute-based typology, it still did not encompass all the possible variations, in particular the degree of workmanship or individual idiosyncrasies. The scheme is reproduced below, but to summarise the scheme used a letter for overall shape and added cordate (J), sub-cordate (G), ficron (M) and flat-butted cordate (N) (*bout coupé*) forms with Roman numerals or lower case letters delineating variations in point (i) and butt shape (a) and also edge shape (e) and tranchet finishing (vi). Pointed forms (D, E and F) were separated into three types dependent primarily on overall standard of working. Intermediate forms were produced by combining two letters, for example JK for a form in-between that of a cordate and an ovate (K).

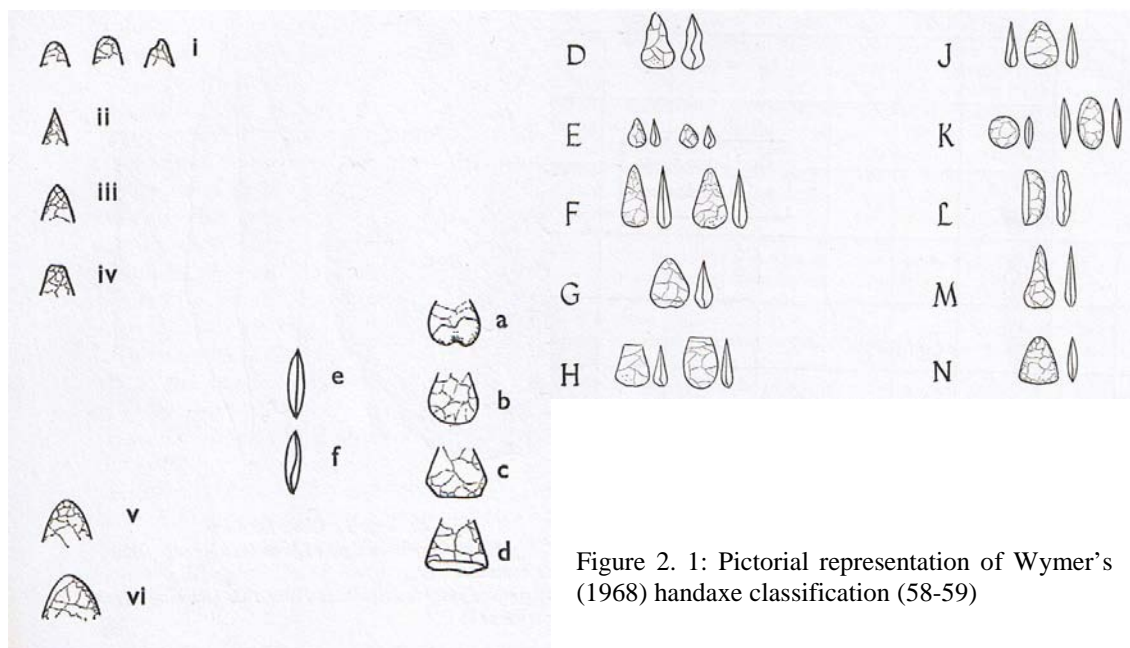


Figure 2. 1: Pictorial representation of Wymer's (1968) handaxe classification (58-59)

The benefit of Wymer's (1968) terminology was clearly that a greater number of types could be identified and a range of variation within types could be categorised.

The scheme should theoretically allow for a greater consistency in the recording of handaxe assemblages but suffers from the probability that different researchers will interpret these categories in different ways. To put it concisely, one person's ovate may be another's cordate. This is because it relies heavily on personal observation and attribution. Although a vast improvement over previous subjective typologies, with a real emphasis on recording actual variability and not subsuming it within broad categories, Wymer's (1968) scheme is not widely utilised and is often supplemented by Roe (1968) in analyses of stone tool assemblages.

So, by the closing decades of the C20th, British lithic researchers had at least two schemes for classifying and measuring variability between handaxes, which acted as a catalyst for subsequent discussions on the nature of bifacial variability in the Lower Palaeolithic. The discussion proceeds with the methods employed by lithic researchers to measure variability.

2.8 MEASURING VARIABILITY

It is clear from the above arguments, that all is far from certain with regards to the origins of bifacial variability. However, it is also crucial to examine how variability can be measured, and what the inherent issues surrounding these methods are. It is important to establish the presence or absence of patterning in the data, as this forms the basis for the hypotheses presented below. It will become apparent in Chapter 3 that the methods for quantifying this variability are also problematic. Firstly, it is necessary to outline the scales of variation which are under examination.

There are several scales of variation which will be addressed in this study. The widest scale is that of variation between Acheulean and Mousterian handaxes. Confirmation of previous researchers' observations and demonstration that variation between the two technologies does exist within the bifacial component will be the first step to assessing the role of handaxes within each technological repertoire. The second scale is that of variation between assemblages, that has been utilised as the basis for many examinations of British Palaeolithic handaxes (c.f. Roe, 1968; White, 1998a). This is perhaps the most pertinent scale of assessment within this study as it has potential application to all British Palaeolithic sites and allows for an examination into the suite of factors that could be causing this variation. This is important for the study of hominin responses to external and internal constraints. The smallest scale of variation under consideration is variation between handaxes in individual assemblages. Regardless of the proposed factors influencing handaxes at an assemblage level, there are no demonstrable instances of assemblages full of identical handaxes so it remains to explain variation within assemblages in relation to smaller scale processes and factors. In order to attempt to categorise and explain variability, it is necessary to find satisfactory methods of measuring it. What follows is an examination of the methods that can be utilised for measuring handaxe variability and the aspects of variability that will be recorded for this study.

Firstly, the consideration of size and shape is the initial exercise that should be undertaken. Following Roe (1964, 1967; 1968) a combination of measurements of size and shape allows the researcher to differentiate between handaxes on the basis of a group of measurements including length, breadth and thickness. This can allow an initial separation to be made and an identification of preferences. This can be combined with a typological assessment of forms, using either Wymer (1968), or

Bordes (1961), to assess the relative frequencies of different ‘types’ of handaxes. Although the majority of these typologies are based on somewhat arbitrary, subjective distinctions, so long as this is recognised and no great conclusions about variability are based upon the results, it is possible to use the differences between assemblages as the basis for examining variability.

When examining variability between Acheulean and Mousterian assemblages, Collins and Collins (1970) worked on assemblages at Oldbury, Kent (MTA) and identified some aspects of handaxe manufacture that differentiated MTA and Acheulean handaxes. The first of these was elongation, with MTA handaxes consistently having a higher elongation index than Acheulean handaxes. They also note differentiation in butt form with Acheulean handaxes rounded in face view and MTA handaxes having a sharp angle between the side and butt. Overall, Acheulean handaxes exhibited a greater statistical variability than MTA which might suggest a stronger cohesive tradition in the Mousterian. It may, of course, also be a product of constraints in morphology or heavy resharpening. The comparability of these results with those obtained from other sites will be examined in Chapter 5.

One possible difference that has become apparent through previous research (Russell, 2002) is that there is a possible variation in the initial stages of handaxe manufacture. It would be informative to examine whether *bout coupé* handaxes are more likely to be manufactured on a flake, and if Acheulean handaxes are more frequently manufactured from the reduction of a whole nodule. There are three possible behavioural implications that would result in this: either it is related to raw material economy and the necessity of producing as many tools as possible from the raw material; or perhaps it is related to a mobility strategy that involves the

production of small flakes that are carried around the landscape and fashioned into tools as necessary; or finally, that handaxes manufactured on flakes are by nature smaller than those made from whole nodules and are therefore more easily transported around the landscape.

Another aspect of morphology that has been suggested by my previous research (Russell, 2002), is the level of retouch observable on the handaxes from each technological tradition, Hayden (1989) believes that the morphologies of all tools are as a result of resharpening and that most resharpening occurs as a result of raw material conservation. Dibble and Rolland (1992) equate the intensity of utilisation with the climatic effect on mobility strategies relating to the availability of raw materials and distances between resources. A key part of Chapter 6 is the development of a new methodology for categorising variability in handaxes that utilises measurements of edge reduction.

Tranchet flakes are another aspect of handaxe manufacture that are available to study. Tranchet removals from the tip of a handaxe are relatively common on handaxes. They are believed to be a form of sharpening that renders a sharp, thin edge to the top of a handaxe, although it is possible that it is the flake that is sought after (Wymer, 1999). Whichever explanation is more likely, to some the tranchet flake represents something of a terminal point to further resharpening but is also seen by Austin (1993) as simply a method of thinning down. What needs to be quantified here is the frequency of tranchet removals and the evidence for further resharpening or use of the handaxe and use of the tranchet flake. What exactly a tranchet removal is for in terms of intention and design aspect is unclear and hopefully this may be resolved with further study. This, and the other features outlined above give some

examples of how variability may be measured. The following section examines the progress made in explaining variability within and between handaxe assemblages.

2.9

EXPLAINING VARIABILITY

As outlined above, the concept of variation in British Lower and Middle Palaeolithic bifacial shape was cemented in the mid 20th Century through the work of Derek Roe (1968) and John Wymer (1968). However, their work stretched little beyond the descriptive, forming a useful basis for categorising handaxes, yet providing little guidance for the reasoning behind the observed variability. Roe's (1968) metrical analysis of handaxe measurements, created the notion of two distinct 'Traditions', each dominated by one form of handaxe, either Pointed or Ovate (as defined by Roe, 1968). Each of these traditions was seen as a distinct cultural group, manufacturing their own brand of handaxe, as opposed to a temporal 'evolution' of one handaxe form to the other. However, the culture-historical perspective proposed by Roe (1968) became a less than satisfactory explanation for the proposed bimodal division of British handaxes and researchers began to seek for alternate theories.

2.9.1 RAW MATERIALS VERSUS RESHARPENING HYPOTHESES

One of the major alternative theories is the raw materials hypothesis proposed by White (1995). White based his research on a paper by Ashton and McNabb (1994) that attempted to provide a plausible explanation for British handaxe variability. Ashton and McNabb (1994) recorded the percentage and position of residual cortex on handaxes from nine different sites in order to reconstruct the original nodule sizes. From this, they found that pointed handaxes were often produced from thick,

elongated raw material, whereas ovate handaxes were made on flat, large nodules. They devised a theory that pointed handaxes were made in situations where raw material was 'conditioning' the outcome of the knapping process. Ovate handaxes on the other hand were being produced without constraint and were a reflection of the intent of the knapper. In this way, all handaxes were being created with a specific mental construct in mind, that of a roughly symmetrical handaxe with sharp, durable edges. The variation that is evidenced in British assemblages is therefore seen as a result of different raw materials requiring individual strategies to realise the intended outcome. White (1995) expanded on this theory by incorporating data from eleven extra sites, confirming the findings of Ashton and McNabb (1994) and concluding that the ovate was the preferred form of the Lower Palaeolithic flint knapper. This rendered British handaxe variation a product not of a cultural or social 'Tradition' but of a wider scheme of the most appropriate response to raw materials (White, 1998a). Chapter 3 is concerned with the validity of the Raw Material Hypothesis, and examines it with regard to one particular critique of Ashton and McNabb's (1994) and White's (1995) raw material hypothesis.

McPherron (1995) has recently launched an attack on traditional models of British handaxe variability, pinpointing reduction intensity as the single variable at the root of all handaxe variability. The central tenet of McPherron's (1994) argument is that variability in handaxe shape is due to resharpening. Specifically, he posits that pointed handaxes are sequentially reduced into ovate forms through resharpening of the tip. This theory is heavily based on the work of Dibble (1987) who theorised that different Mousterian scraper forms could be combined into one chain of reduction. McPherron (1994) applied this to continental handaxe assemblages noting a relationship between the relative length of the tip and the overall planform. He then

applied this to Roe's (1968) dataset, concluding that British handaxes also varied along the same trajectory (McPherron, 1995). This scheme sees handaxe variation as an intrinsic part of the use-life of a tool, with handaxes being manufactured, used and subsequently resharpened before discard. This theory would see handaxe shape as a by-product of manufacturing processes rather than a functional or cultural intention. The assumptions and conclusions of the McPherron (1995) paper are examined and critiqued in Chapters 3 and 5. These are then weighed against the conclusions of Ashton and McNabb (1994), White (1995) and also the opposing views of Wenban-Smith (2004).

2.9.2 HANDAXES, RAW MATERIAL AND CURATION

The lack of suitable and abundant raw materials in a given landscape is another possible focus for the study. Research indicates that different strategies were adopted by Palaeolithic hominins utilising areas where raw materials were in limited supply (Kelly, 1988). One possible strategy is the transportation of handaxes and is linked to the curation of individual pieces through a landscape (Binford, 1973). Another strategy is the use of lower quality non-flint resources, where tools are produced on materials such as quartzite and basalt that are harder to work (MacRae and Moloney, 1988).

One of the key concepts in this debate is the notion of curated and expedient tools, terms defined by Binford (1973) and used subsequently to delineate two different types of tool manufacturing and use-related behaviour. Tools made using an expedient technology are manufactured, used and discarded in the same location,

generally to satisfy an immediate need, whereas tools made using a curated technology are manufactured, possibly used, then removed from their point of origin and transported around the landscape, incorporating perhaps several episodes of use, resharpening and reuse.

Odell (1996) has examined the notion of curation, and found it to be a concept that had been poorly defined and often misinterpreted by researchers. In the same year, Shott (1996) re-examined the concept of curation in an attempt to renew the concept in the face of substantial criticism (cf. Nash, 1996). He sees curation as a continuous relationship between the maximum amount of utility an object has and the amount of this utility that is extracted from the object before it is discarded. This includes aspects of transportation and recycling but these are not the defining factors. Utility can be defined as the total work that an object can perform (use) or the total product that it can deliver (function). A good comparative example of this is a handaxe where the utility is in the use of the object compared to a core where the utility is in the amount of produced flakes or blades. An alternative perspective is that maximum utility is the potential use-life for a tool and the realised utility is the actual period of use. In this sense, curation can occur to different degrees along a continuum from little to depletive. All tools are seen as curated as soon as they are used, with those discarded before they are depleted, termed by Shott as *de facto* refuse. Raw material availability and mobility are influencing factors and curation in turn influences assemblage formation. Shott cautions the assignment of types and functions based on frequencies of different objects within an assemblage due to changes in form during use-life. This is also argued by Dibble (1987) who demonstrates that at least four different scraper ‘types’ in the French Mousterian are stages in the reduction of a single scraper. Shott (1989) believes that within a class of object, varying stages of

use-life are likely to be represented. To illuminate this process, it is necessary to consider the ways in which stone tools become a part of the archaeological record, in short, the discard processes. Shott names breakage in production, abandonment during or after production, loss or breakage in use, recycling, abandonment in use and depletion as the key discard points. These processes will be considered in more detail in Chapter 6. By looking at ethnographic parallels, Shott noted that there was a positive relationship between the manufacturing cost (minutes) and the use-life of an object.

Curation, when properly defined, is especially relevant to the study of handaxes as they are by nature tools that are created and used, then either discarded or reworked and reused. This was the basis of an examination of curated and expedient manufacture of handaxes attempted by Soressi and Hays (2003). Their research, which considered a combination of resharpening and usewear on handaxes from La Grotte, in the Périgord area of France, has been very informative on the nature of use and re-use of handaxes within French Mousterian assemblages. By virtue of having excellent preservation of usewear residues, they were able to identify areas through usewear analysis, where a handaxe had been used, then partially resharpened and subsequently reused. Their concern was with the definition of expedient and curated technology when applied to the Middle Palaeolithic, citing Binford's assessment of Middle Palaeolithic technology as expediently manufactured, used and discarded in the context of immediate need. Their demonstration of multiple areas of use and reuse combined with the non-local derivation of raw material for the handaxes excavated on site, led them to believe that the La Grotte handaxes were curated implements. However, they believe the expedient versus curated division is spurious on the basis that both technological strategies may be employed by the same group as

different situational responses to problems encountered in the landscape. The results of Soressi and Hays' research suggest that Middle Palaeolithic hominins possessed the capacity for curated technology; able to interchange between the two technological strategies when necessary. Overall, this indicates a complex pattern of different behaviours incorporating manufacture, use and discard activities. This pattern is further complicated by the conclusions of Shott and Weedman (2007) who focus on ethnographic evidence that suggests different individuals may have different perceptions of how long objects need to be used before they are rejuvenated.

A further option available is the use of non-flint materials to provide support for the traditional flint-based handaxe assemblage. Dibble and Rolland (1992) suggest that the uses of local versus exotic raw materials could be informative, and may be indicative of which strategy of stone tool manufacture is preferable. For example, whether a better quality exotic raw material has been used to make one type of tool, which may also be transported, versus more expedient production on local raw material. The work of Sharon (2008) counters somewhat the idea that raw material affects the knapping processes in his examination of handaxes produced on a range of different raw materials from several sites across the Old and New World. He concluded that across flake-based Acheulean industries there was a basic similarity in variation that cross-cuts raw material type. From this, he extrapolated that a similar approach to handaxe manufacture cross-cuts raw material type in these contexts. Whilst informative, the lack of any consideration of raw material quality within a single raw material type, renders these observations difficult to apply in a British context.

2.9.3 FUNCTIONAL AND STYLISTIC FRAMEWORKS FOR VARIABILITY

Crompton and Gowlett (1993) utilised the biological concept of allometry on African bifacial assemblages at Kilombe and Kariandusi (Gowlett and Crompton, 1994), where key metrical features were examined to see whether they increase or decrease in relation to size. From this, they concluded that a significant amount of variability in bifacial assemblages is related directly to the size of the object, although the allometric patterns were not constant between assemblages. The patterning in variability indicated that different considerations were affecting the allometric relationships in different locations, for instance, at Site Z (Kilombe) the maintenance of tip thinness was paramount. They concluded that allometric relationships were determined primarily by functional factors, to maintain the relationship between weight and size.

Davidson and Noble (1993; Davidson 1991) contributed to the discussion of variability in bifacial assemblages by asserting that variability in form was related solely to function and use. They dismissed the notion of preferred form, seeing flint knapping transmission occurring through imitation, not due to a deliberately imposed form. Their ‘finished artefact fallacy’, is the concept that researchers see a handaxe as a designed tool when in fact it is an accidental consequence of basic properties of bifacial knapping, combined with the notion of the handaxe as a core for the production of flakes. They see the standardisation recorded by Wynn and Tierson (1990) as a product of linear mechanical flake production, rendering void Gowlett and Crompton’s (1994) argument that standardisation is a result of mathematical planning and language. Whilst the research presented in Chapters 5-7 will tend towards the assertion that there is too much emphasis on the idea of a preferred,

finished form that may not often be visible in the archaeological record, there is also much opposing evidence presented over these three chapters that contradicts Noble and Davidson's (1993) functional explanations of handaxe form.

McPherron (2000) examined the work of Wynn and Tierson (1990) and Gowlett and Crompton (1994) as part of his research into what the relationships between size variables elucidated about the mental processes of hominins. McPherron (2000) observed that elongation was one of the key factors involved in the reduction of handaxes. This is echoed by the work of Jones (1994) who asserted that elongated shapes demonstrated a better ratio of cutting edge to overall weight than less elongated shapes. This is at the expense of a higher likelihood for end-shock to occur during manufacture, and so there is a complicated set of functional and logistical considerations involved in the shape of a handaxe. McPherron (1994) believes that resharpening was aimed to maintain the width of the piece over the length in order to extend use-life. In conclusion, he stated that if there were a mental template involved in the creation of handaxes in the Acheulean that it was identical across the Old World.

Gowlett (2006) has recently revisited the idea of allometry and preferred form in the Acheulean record. In doing so, he outlined a set of bifacial imperatives which he suggests are the basis with which hominins approach the creation of a handaxe. These include a glob butt which remains static and acts as the centre of weight for the handaxe, forward extension in the form of a tip, support for a working edge and the ability to adjust the thickness without affecting the basic dimensions of the piece. From this, it can be assumed that the ability of the knapper to imprint an object with these imperatives can be influenced by cultural and functional (raw material)

constraints as well as the skill of the individual knapper to turn the concept into a reality.

A concept inherent in bifacial manufacture which appears to contradict Noble and Davidson (1993) is the presence of advance levels of symmetry in many handaxes. This has been examined recently by Machin (Machin, Hosfield and Mithen, 2005) who tested the functional significance of symmetry by using handaxes to butcher deer. She contends that it is now beyond doubt that handaxes were used for butchery, as evidenced through use-wear (cf. Keeley, 1980; Soressi and Hays, 2003) and experimental analysis (cf. Jones, 1980). Machin's thesis concerned whether symmetry was designed to aid functional use or whether it represented a symbolic and social function (Machin, 2006). She concluded that there was no relationship between symmetry and function, instead finding that the nature of the cutting edge had the most bearing on the suitability of a handaxe for butchery. Her subsequent finding (Machin, 2006) that symmetry was not related to raw material, leads her to suggest that symmetry is a non-utilitarian factor, directly in contradiction with the assertions of Noble and Davidson (1993). It should be noted that none of Machin's (2006) handaxes were particularly non-classic in form with straight, regular edges and did not retain cortical edges, so the application of this data is limited.

2.9.4 CULTURAL EXPLANATIONS FOR HANDAXE VARIABILITY

When attempting to look at the possibility that variation in bifacial assemblages from the Lower and Middle Palaeolithic of Britain is caused by cultural factors, there is immediately a connotation of the culture-historical notion of distinct 'cultures' making their own types of handaxes as a form of social identity. For most

Palaeolithic students this immediately brings recollections of undergraduate lectures on the ‘Mousterian Debate’ (Bordes, 1953; Binford, 1989; Mellars, 1992) where Mousterian technocomplexes were seen as culture-, task- or chronologically-specific. However, this is not the meaning of ‘cultural explanations’ in this context.

The following study will attempt to assess whether there is any evidence that the functional and practical debates about resharpening and raw materials outlined above is missing any notion of individual influence – i.e. the role of the knapper in producing a handaxe. A recent collection of papers concerning the discovery and examination of the hominin individual in the Lower and Middle Palaeolithic (Gamble and Porr, 2005) attempted to find ways of identifying the signatures of individual action within lithic assemblages. Whilst opinions on the role of the individual in creating handaxes have already been demonstrated as mixed, the general consensus from this monograph was that it was possible to distinguish the individual in the Palaeolithic through stone tools, not only as objects created by individuals but also as agents of mediation between a hominid and the landscape (Gamble and Porr, 2005). Granted this is far from a generalised notion of ‘cultural’ explanations of variability in handaxe assemblages, but it does represent a watershed commitment to looking for evidence of small-scale human behaviour within lithic assemblages.

Central to this will be the concept of preferred form as mentioned earlier. Wenban-Smith (*et al*, 2000) accuses the main proponent of the preferred form concept, White (1998a), of portraying Palaeolithic hominins as mindlessly pursuing ovates except when situational factors intervene, whilst he would see more stylistic and adaptive behaviour being reflected in the archaeological record. Wenban-Smith (*et al*, 2000) is

one of very few British critics of the Raw Material Hypothesis. He raised the concern that Ovate forms could easily be manufactured on most types of raw material were this the intended and preferred form shared by Middle Pleistocene hominins. In addition he cited examples, including his own analysis of the Red Barns assemblage, which clearly showed Point-Dominated assemblages associated with access to excellent quality raw material. In his discussion of handaxe form and raw material, he is drawing attention to the fact that, in metrical terms, raw material does not provide any restrictions on whether a Point or Ovate is manufactured. The argument, taken at its most fundamental level does not object to the association between shape and raw material access but to the fact that this relationship was direct and underpinned by preference. In his 2004 *Lithics* paper, Wenban-Smith uses the examples of a large ficron and cleaver from Cuxton to suggest that variety in distinctive handaxe shapes increased throughout the Acheulean and into the Mousterian. This begins with twisted ovates and the Clactonian in MIS 11, and is complemented by plano-convex handaxes, ficrons and cleavers between MIS 10 and 6. This can be supplemented with the bout coupé phenomena in MIS 3/4 (see above) which is seen as a chronologically specific regional variant of the MTA. He sees this very much as the deliberate imposition of types in a chronological progression, returning to the cultural-historical roots of Roe (1968) and Bordes's (1968) 'cultural geography'. This is very much a cultural explanation for variability, which eschews the typo-functional arguments of White (1998a) and McPherron (1994) for a modern take on a traditional idea, that of the knapper intentionally producing certain forms, leading to the underlying inter- and intra-assemblage variation which is evidenced in British handaxe-dominated sites.

White (in White and Plunkett, 2004) himself has recently formulated a more fluid and individualistic explanation for the notion of preferred form. He would now suggest that handaxe forms are deliberately created within a flexible but structured ‘mental construct’ which consists of the contextualised choices and actions of the individual knapper. He still asserts that ovates are a ‘preferred form’ where limitations do not influence the knapper:

‘Handaxe assemblages are therefore highly variable, with similarities and difference not due to a group template, but possibly to the imitation and emulation of particular role models within the group. At a much coarser scale is assemblage level biases for one of two basic shapes, which we believe was caused by differences in the raw materials used in the different assemblages and the recursive technological responses brought forth by knowledgeable hominins to extract a fully functioning tool from them.’ (White and Plunkett, 2004, 161).

Another paper which promotes the notion of diversity and similarity inherent in Acheulean handaxes is Lycett and Gowlett (2008) which posits that there is a generic over-arching unity in Acheulean assemblages which contains more localised diversity related to a model of social transmission of many to one within regional groupings. The authors see variation as being clinal as opposed to showing abrupt differences which appear to reflect a tradition passed from individual to individual. This theory sees a combination of the idea that the Acheulean as a whole is a unified entity which contains small-scale variety within and between assemblages linked to social factors.

Other examples of cultural attribution often occur when ‘extreme’ handaxes are found in a Palaeolithic context. The ficron and cleaver from Cuxton mentioned above are examples of large implements which are discarded when there is potentially more use-life left. Large handaxes were a subject of interest for MacRae (1987) who

provided numerous examples of handaxes which were discarded when they were still extremely large. This phenomena is seen to offer an insight into cultural practices in the Acheulean because it cannot be demonstrated that these ‘giants’ conform to any specific notion of resharpening or raw material conservation. They are often cited as examples of ‘sexual selection’ (Kohn and Mithen, 1999). Linked to cultural practice is the newly important idea of paired handaxes as written about by White and Plunkett (2004), Pope (Russell and Watson, 2006) and Hardaker (2006). This notion explores the discovery of near identical handaxes which have often been discarded together. From a cursory examination of all the specimens to date, they are often handaxes that fall in the larger (>150mm) section of the spectrum. Paired handaxes are seen as providing access to the stylistic signature of individual knappers (White, 2004) and perhaps are discarded to act as signals within the landscape (Pope, Russell and Watson, 2006). Pope, Russell and Watson (2006) have also argued that the apparent standardisation of handaxe forms is in part due to the imposition of a ratio of length to width that is replicated through forms in the natural environment. This envisages handaxes functioning as signals in the landscape, drawing on the biological concept of stigmergic behaviour.

2.9.5 ENVIRONMENTAL EXPLANATIONS FOR HANDAXE VARIABILITY

The environmental explanation for bifacial variability concerns the theory that the primary influences on the design and manufacture of a handaxe are environmental factors. The design of a stone tool may have many considerations bound up with it, for example functional, economic and social constraints can all be influencing factors (Nelson, 1991). A study that promotes the impact of environmental constraints on

handaxe design is presented by Pettitt (*unpublished*) who attempts to place Mousterian variability in the context of mobility. He believes that the variability in stone tool technology between the periods of MIS 7 and MIS 3 can be explained in terms of adaptation to the environment. He states that Levallois is essentially a mobile technological adaptation as it is the only type of stone tool that is curated for long distances in the landscape. Mobility over large areas is as a product of scattered resource availability and an uncertainty due to the unfamiliarity of the landscape. This is contrasted with MIS 4, characterised as a hostile environment that places an artificial restriction on the level of mobility possible, leading to mobility over a small area and an increased familiarity with the environment. In MIS 3, local raw materials are heavily exploited for the manufacture of *façonnage* style technology. The handaxe is seen as a mobile tool that can be used for general tasks. High mobility within restricted ranges of exploitation is here seen as a reaction to a rich resource base that would permit the exploitation of a smaller amount of landscape. This model suggests that the production of handaxes is linked to low mobility, a greater familiarity with the landscape and the utilisation of easily available raw material. This is tied to the concept of curation, explored earlier in this chapter, and also the concept of risk management.

The costs associated with stone tool making behaviour can relate to several aspects of manufacture, either individually or in combination. Procurement, production and use are all areas where costs can be high and the currency of cost in these situations often is defined through time or energy. Handaxes can minimise risk in several ways. Bifacial production is seen by Barton (1997) as a means to counter raw material scarcity or an increase in the need for raw material. Scarce or poor quality raw material increases the effort required to produce tools that meet the need between

sources of raw material (Kelly, 1988). This is why a general-purpose tool such as the handaxe is ideal for a mobile toolkit as it can bridge the gap between raw material sources and provide a general-purpose solution to meet almost any situations. Handaxes are representative of strategies designed to increase the use-life of a tool. Barton (1997, 146) believes that '*lithic morphology has little freedom to vary independently of the larger techno-economic system in which it plays a fundamental role.*'

The brief discussion above cited some ways in which the environment could be responsible for bifacial variability. Differences in mobility and differential responses to risk and raw material shortages may have produced tools which were variable in design, resulting in the variability seen within assemblages. This may be posited as a possible reason for variability between Mousterian and Acheulean assemblages.

2.10

SUMMARY

This chapter has focussed on defining key terms, examining the physical mechanics of manufacture and examining the history of handaxe research and specific methodological approaches. It has also briefly presented the wider picture of hominin evolution and lithic manufacture, exploring past issues and what the current status of knowledge actually is, focussing in a more generic sense on the issues which may have a bearing on the explication of handaxe variability. What remains to be outlined are a series of hypotheses which represent various competing theories on the nature of variability. These hypotheses will then be utilised in the subsequent analysis and used to conclude the study by examining whether any can be discounted, and which,

if any, provide the most plausible explanation for the presence of variability in handaxe-dominated assemblages in the Lower and Middle Palaeolithic.

2.11

HYPOTHESIS FORMULATION

In the introduction I outlined two main questions, which were intended to form the basis for the study of British handaxes in the Palaeolithic:

1. Is there a common causal factor that governs variability in the form of handaxes throughout the British Palaeolithic?
2. Can metrical variability be explained through a single unified approach to handaxe shape?

These two questions can be combined to formulate a number of plausible hypotheses with which I can examine the causes of variability in Lower and Middle Palaeolithic handaxes. This can be achieved by looking at the possible factors which could be contributing to the way handaxes are formed, through the consideration and critique of existing theories into the basis of metrical variability. From the literature survey conducted above, it seems there are several competing themes, the central theories of which form the basis for the hypotheses I will outline below. I have devised three competing hypotheses, which are proposed by some of the leading members of the variability debate which have resurfaced several times over the course of the preceding discussion. The aim of the data analysis presented in Chapters 3, 5 and 6 will be to test each of these hypotheses to see if any can partially or fully explain the variability inherent within bifacial assemblages.

RAW MATERIAL HYPOTHESIS

The **Raw Material Hypothesis** states that variability in handaxe shape and size is related directly to the type, size and quality of raw material that it was produced upon.

This hypothesis emerged from the work of White (1998a) and Ashton and McNabb (1994). Their research contends that the vast majority of variability in form evidenced within British bifacial forms is due to the type and quality of raw material used to create them. I do not intend to recreate White's (1998a) methodology, rather to examine his conclusions and examine whether they apply to the data I have collected. I will be looking to see whether, at the assemblage level, sites with poor quality raw material sources are dominated by pointed handaxes, and vice versa as White (1998a) proposes. This must also be tempered with an examination of whether there are any other factors involved that may be obscured by an obvious division of raw material type. This hypothesis is also supplemented by the 'preferred form' notion (Ashton and White, 2003), which dictates that ovate handaxes are preferentially produced when feasible. Based on this theory and using Boxgrove as an example of a site with excellent quality, relatively abundant, locally available raw material, it should be possible to examine what exactly the preferred form is.

RESHARPENING HYPOTHESIS

The **Resharpening Hypothesis** states that the differential reduction of handaxes is the key component of bifacial variability.

The resharpening hypothesis, as suggested by Dibble (1987) in relation to Mousterian scrapers, then adapted by McPherron (1995) in relation to handaxes, is the key opponent of the Raw Material hypothesis. The key facet of this hypothesis is that the form of a handaxe, and by association the range of variability present within an assemblage, is due to the intensity of reduction that it has been subject to. As McPherron's (1995) methodology is well documented and easily replicable, it will be possible to reproduce his analysis and critique his methods using my data. This will go some way towards either refuting or confirming his theory in an empirical manner. The expectation is that different bifacial forms are produced by reduction, with large pointed handaxes becoming smaller, more ovate forms. This would be completely independent of raw material type or quality.

CULTURAL HYPOTHESIS

The **Cultural Hypothesis** states that the production of handaxes is linked to social factors that transcend both geographical and temporal boundaries.

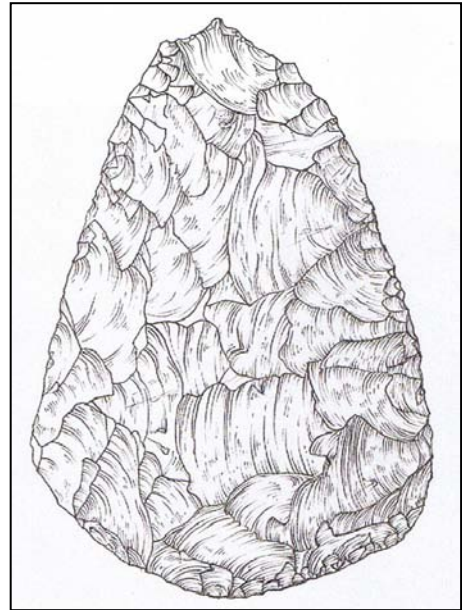
The cultural hypothesis is gathered from many writers, both contemporary and past, who believe that variability in handaxe form is related to the distinctive cultural styles of manufacture of different hominin groups (cf. Roe, 1964, Bordes, 1953). This dictates that variation in form will be linked intrinsically to deliberate hominin production and is related to the concept that handaxes contain social information transmitted by the user through deliberate placement of handaxes in the landscape (Pope, 2002). In this case, the production of handaxes would be evidenced where the transmission of social information was important, whether for inclusive or exclusive

means. The evidence for this in the archaeological record is most likely to be seen where the production of handaxes cannot be attributed to any other influencing factor, such as raw material availability. Any variation which seemingly is not related to any other factor, may be examined within a cultural framework, although the possibility remains that it may be random, or a result of many factors. In saying this, I do not believe that all variation in handaxe form is due to a deliberate cultural imposition of an idealised template unique to that particular group. What I do believe, alongside the thoughts of Wenban-Smith (*et al*, 2000) amongst others, is that it will be possible to demonstrate that some variability in form may be explained by cultural factors. Whilst it will undoubtedly be difficult to find a scientific basis for distinguishing cultural variation from those factors outlined above, and indeed random variation, it is nevertheless the case that extreme and unusual forms of handaxe have often been singled out as representing some element of cultural preference (MacRae, 1987). Indeed, the notion of preferred form (Ashton and White, 2003) dictates an intention on the knapper's behalf to create a particular type of handaxe when circumstances render this possible. Through the course of this research I intend to ascertain if such a type exists and for what reasons it is preferable.

DISCUSSION

These three hypotheses are designed to be wide in scope in order to encompass most of the major factors which were identified in the preceding literature survey. There are likely to be other possible influencing factors, and these may become apparent during the subsequent analysis. The questions outlined earlier are the main focus of the study, but these are by no means the only questions that this study will seek to answer. It is also my intention to compare Mousterian and Acheulean handaxes in order to confirm the assertion by Collins and Collins (1970), amongst others, that Mousterian handaxes are metrically and technologically different to Acheulean ones, and if so, examine the possible reasons for this.

The following chapter looks in more depth at the Roe (1968) and McPherron (1995) methodologies, examining the basis for two of the hypotheses outlined above. This then proceeds to Chapter 4 which introduces the sites used in the subsequent analysis, assessing the data available for each site, the potential for study and the number of handaxes in the sample.



CHAPTER THREE: REVISITING ROE

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The literature survey in Chapter 2 introduced the major theoretical aspects pertaining to the debate over bifacial variability. Central to this debate is the work of Roe (1964; 1967; 1968) and the development and application of his metrical methodology for objectively typologising handaxe assemblages from the Lower and Middle Palaeolithic. Roe's metrical approach has cast a profound and lasting influence over subsequent British Palaeolithic studies, in particular the work of Ashton and McNabb (1994) White (1998a) and McPherron (1995). All of these key research papers contain methodologies based on Roe (1968), in particular relation to his division of handaxes into Points, Ovates and Cleavers. Chapter 2 set the context of Roe's work alongside that of his predecessors and contemporaries. The purpose of the following sections is to examine the fine detail of the metrical methodology outlined in Roe (1968) and the resharpening (McPherron, 1995) and raw material (White, 1998a) hypotheses which are based upon it. The purpose of this analysis is twofold: to enable a greater understanding of the paradigm that underpins almost every analysis of Palaeolithic handaxe-dominated assemblages in Britain; and to utilise the insight gained from this analysis to examine and critique the most prominent studies of British handaxe variability in the last fifteen years.

It is important not only to consider the minutia of the Roe's (1968) methodology but also to site the research within its academic context. The creation of a metrical methodology for categorising variability in handaxe-dominated assemblages in Britain formed part of Roe's PhD thesis (1967), along with a Gazetteer documenting

sites and find-spots containing Lower and Middle Palaeolithic assemblages in Britain. There is little in the published material to suggest the motivation behind this epic undertaking, save for references to the need for objectivity and the idea of metrically defining ‘Traditions’ of handaxe manufacture linked to cultural groupings (Roe, 1964). Other authors were also looking at handaxes in this period, with American researchers concerned with functional analysis (Frison, 1968), experimental replication (Crabtree, 1966) and quantitative attribute analysis (Sackett, 1966). In Africa, Kleindienst (1961) was looking at variability in later Acheulean assemblages through a Bordesian comparison of percentages of different tool types. In most analyses of this period handaxes were one type of artefact, to be measured in terms of relative frequency against other tool types. However, the most important comparator for the type of analysis undertaken by Roe (1968) is the work of Francois Bordes (1961) on the creation of a typology for Palaeolithic tools. Whilst Bordes’ typology is primarily a morphometric one, when creating a handaxe typology Bordes also used metrical criteria (summarised in Debénath and Dibble, 1994) to distinguish between types, using measurements very similar to those utilised by Roe (1968). Surprisingly, at no point in either paper (1964; 1968) does Roe make reference to the typology devised by Bordes (cf. 1950; 1961).

3.2.1 BORDES’ PALAEOLITHIC TYPOLOGY

Bordes’ typology (1961) is much more widely proliferated than Roe (1968) as it is applicable on a basic level to assemblages across the Old World. Debénath and Dibble (1994) presented a handbook of Palaeolithic typology translated from Bordes’ typology simply because it was the most widely used and they also credit Bordes with creating the first standardised terminology. Bordes selected three major aspects

of metrical morphology to distinguish between bifacial types: thickness relative to width (refinement), length relative to width (elongation) and the shape of the lateral and distal edges. These ratios are calculated using six standardised measurements:

Measure	Relevance
Length	The three basic measurements of size. Used in their own right as an indicator of variability in overall size and also to calculate Elongation (length/width) and Flatness (Width/Thickness)
Maximum width	
Thickness	
Distance from the base to maximum width	Used to calculate the location of the maximum width by dividing length by it.
Width at $\frac{3}{4}$ length	Used to calculate pointedness by dividing it by maximum width.
Width at Midpoint	Used to define the roundness of the edges by dividing it by maximum width.

Table 3. 1: Summary of the measures used in Bordes' calculations (Bordes, 1961)

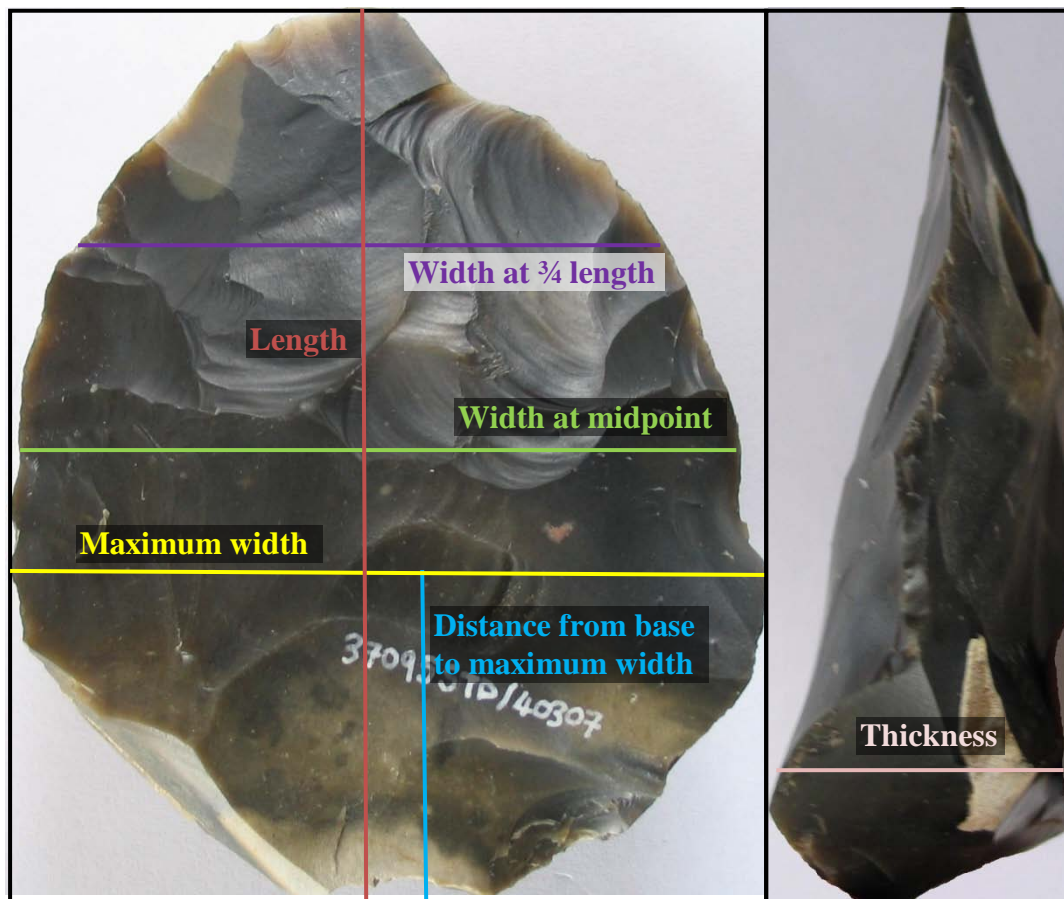


Figure 3.1: Diagram showing the measurements used in Bordes' handaxe shape calculations (Debenath and Dibble, 1994).

When the measurements are recorded and the ratios calculated, handaxes are first divided on the basis of 'Flatness', with a ratio of 2.35 dividing flat and thick handaxes. Further division is then made on the basis of a combination of the location

of maximum width (Length/distance from base to maximum width) and the roundness of the edge (width at midpoint/maximum width). Labels of Ovate, Cordiform, Subtriangular and Triangular, divided further in terms of elongation, are then given to handaxes, based on overall shape as indicated by the calculated ratios. Overall, Bordes defined twelve main types of handaxe, with numerous subdivisions along the lines of irregular and typical forms. Figure 3.2 shows a graphical representation of the major calculations required for the Bordes (1961) typology:

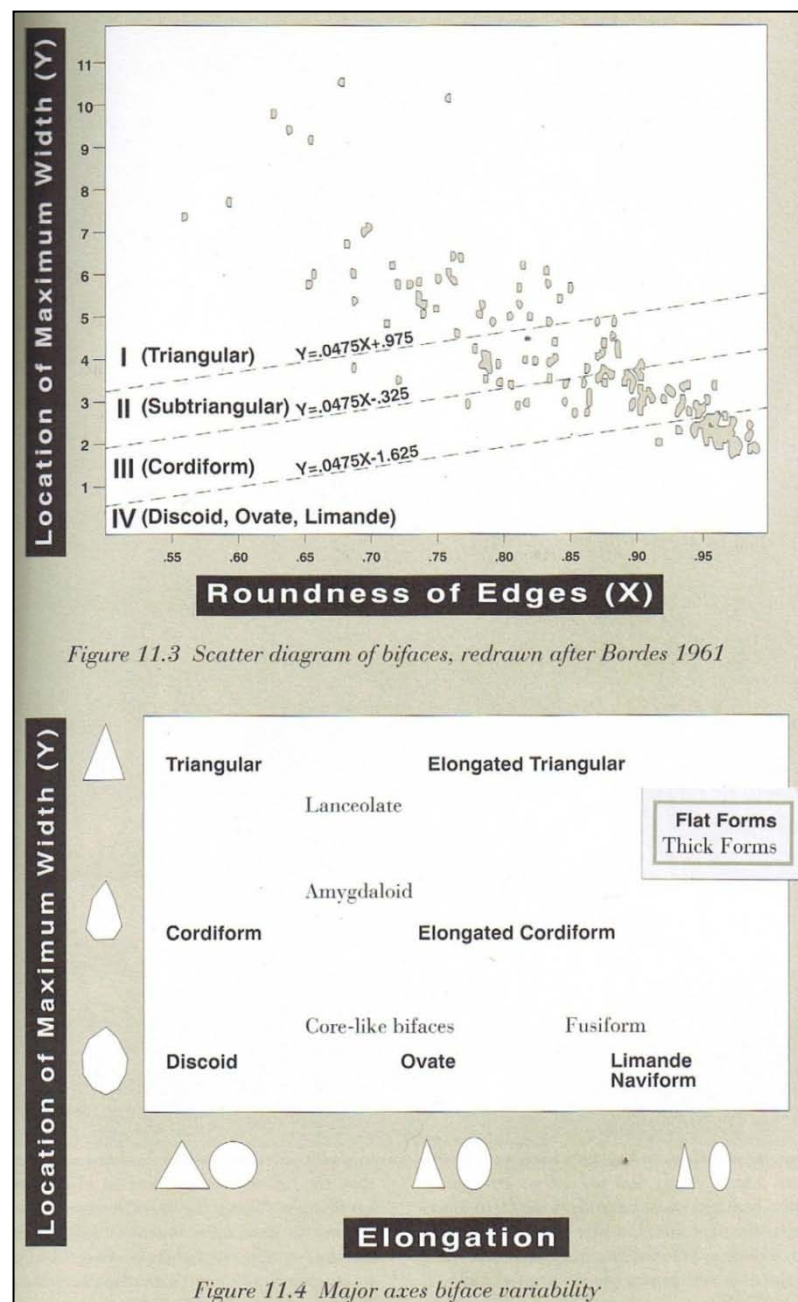


Figure 3. 2: Graphical representation of the allocation of types according to Bordes (1961) (Taken from Dibble and Debénath, 1994, 133).

Ironically, despite numerous calculations, the final allocation of type is fairly subjective and Bordes (1961) uses a similar approach to that subsequently favoured by Wymer (1968) by defining a large variety of types. Roe's (1968) methodology is somewhat different, eschewing any subjective definition of type in favour of purely metrical categories. The following section outlines the basics of the metrical methodology and typology.

3.3 HANDAXES IN A METRICAL FRAMEWORK

As outlined above, Roe's metrical methodology was devised with the aim of producing an objective typology (1964, 266) for comparing handaxe assemblages from the British Lower and Middle Palaeolithic. It provided a direction for the classification of handaxe forms and set out a logical series of measurements which recorded major aspects of metrical variation as evidenced in tool form. His methodology was developed by the analysis of data collected by measuring handaxes from 38 sites in Britain, spanning the Lower and Middle Palaeolithic, rejecting sites that did not have a substantial amount of implements or a lack of demonstrable assemblage cohesion. The study represented a comprehensive and exhaustive undertaking which has been built on and refined by others, yet the basic paradigm continues to remain as the framework of first resort through which we understand and classify the British Acheulean record. Roe (1968) can be credited with the development of the first comprehensive methodology that categorised bifacial variability on the basis of a combination of metrical measurements. These measurements are summarised below:

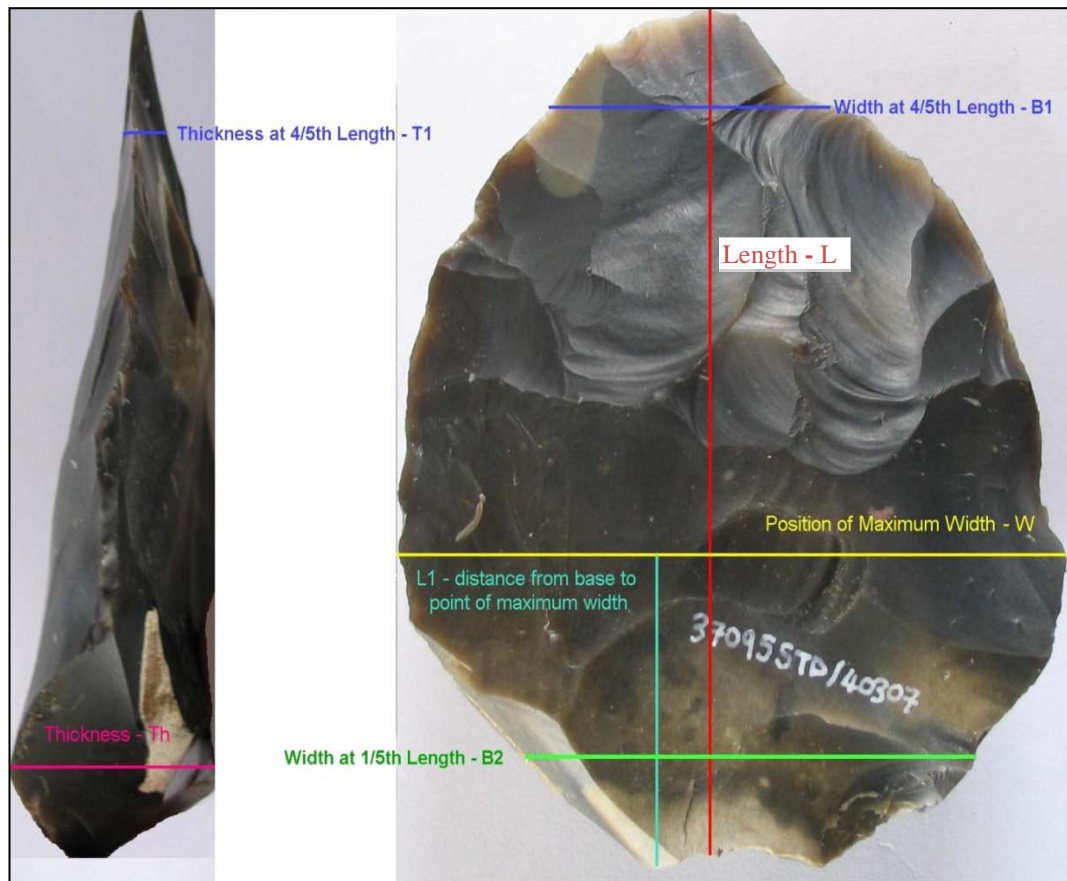


Figure 3. 3: Diagram showing the measurements used in handaxe shape calculations (Roe, 1968).

These measurements combined the traditional measures of maximum length (L), maximum width (B), and maximum thickness (Th), with measurements such as distance from the butt to the point of maximum width (L_1). In contrast to Bordes (1961), Roe did not measure the width at midpoint or $3/4$ length, instead measuring the width at $1/5^{\text{th}}$ (B_2) and $4/5^{\text{th}}$ length (B_1) and the thickness at the tip (T_1).

Measure	Abbreviation	Description	Relevance
Length	L		The three basic measurements of size. Used in their own right as an indicator of variability in overall size and also as a part of the shape ratios (see below)
Width	W		
Thickness	Th		
	L_1	Distance from the base to the point of maximum width	Key variable in the determination of 'Pointedness'
Width at Tip	B_1	Width at $4/5^{\text{th}}$ Length	Minor variables – used for calculating other shape ratios.
Width at Base	B_2	Width at $1/5^{\text{th}}$ Length	
Thickness at Tip	T_1	Thickness at $4/5^{\text{th}}$ Length	

Table 3. 2: Summary of the relevant dimensions used in handaxe shape calculations.

The purpose of these measurements was to define the size, shape and refinement of the handaxes, seen as key to dividing assemblages into ‘Traditions’. Roe (1964) acknowledged that the measurements defining size, namely weight, length, breadth and thickness, can be linked to raw materials and functional constraints as well as being a product of cultural choice.

Ratio	Calculation	Description
Pointedness	L_1/L	Use to separate handaxes into Points, Ovates and Cleavers (see below). Also known as: Relative Location of the Maximum Width or Planform.
Refinement	Th/B	Equivalent to Bordes’ (1961) ‘Flatness’ – relative thinness when compared to width.
Elongation	W/L	Measures if the handaxe is narrow or broad relative to Length.
Shape	B_1/B_2	Compares the width at the tip to the width at the base – utilised as a shape ratio in the tripartite diagrams.

Table 3. 3: Explanation of the calculations and ratios utilised in Roe’s (1968) methodology.

Of all of the ratios and measurements calculated by Roe (1968) (Table 3.3), the aspect which has dominated more recent discussion of handaxe form is the tripartite division of handaxes into Pointed, Ovate and Cleaver forms. It is important to note that a Roe Cleaver is not the same as an African cleaver which are based on morphology rather than metrics. The genesis of this paradigm is seen when Roe (1964) demonstrates that a typical ficron, ovate and cleaver can have the same figure for the B/L ratio despite their obvious differences in shape. He identifies that the major difference between these three shapes is in the position of the maximum width (L_1). ‘From this simple fact emerges the very promising index L_1/L as an indicator of shape’ (1964, 260). This classification, which is measured on the basis of the relative position of maximum width of the tool, stems from an arbitrary division of the L_1/L ratio:

Category	Calculation	Result	Traditions
Point	Length (L) / Distance from the base to the point of maximum width (L_1)	0.00 – 0.350	> 60% Point-Dominated >50-60% Uncommitted (Pointed)
Ovate		0.351 – 0.550	> 60% Ovate-Dominated >50-60% Uncommitted (Ovate)
Cleaver		0.551 – 1.00	> 60% Cleaver-Dominated >50-60% Uncommitted (Cleaver)

Table 3. 4: Summary of Roe’s metrical Traditions (Adapted from Roe, 1968).

In Roe's scheme, each handaxe was designated as either a point, an ovate or a cleaver (Figures 3.4-3.5, below). Each of the sites he studied was examined, and considered to be dominated by a particular shape if there were more than 60% of that type in the assemblage. Although it was possible that there could be cleaver-dominated assemblages, none were found.



Figure 3. 4: Three photographs illustrating examples of a point (La Micoque), an ovate (Lynford) and a cleaver (Cuxton) with the point of maximum width indicated by the red line (Photos: KE).

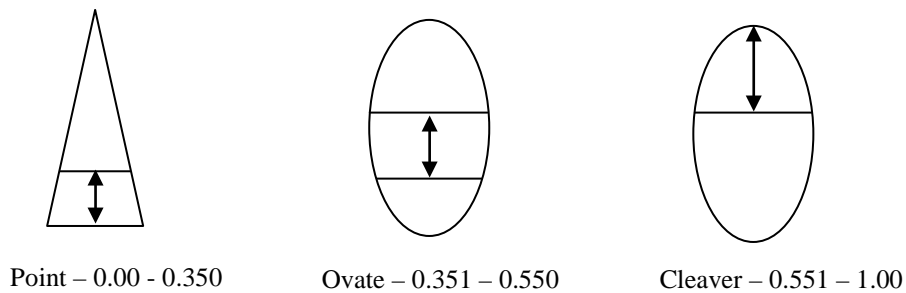


Figure 3. 5: Basic diagrammatic representation of Points, Ovates and Cleavers. Arrowed area represents the range of possible positions for the point of maximum width.

Whilst the possibility exists within the metrical framework for an even distribution of all three types within any given assemblages, Roe (1968) determined that assemblages tended to break down into Point-Dominated or Ovate-Dominated groups. These groupings could be distinguished by the addition of other observable

features such as the incidence of tranchet removals or plano-convexity. From this he tentatively interpreted that a cultural or chronological pattern was possibly responsible for the groupings, acknowledging that stricter chronological controls were necessary to confirm this (Roe, 1968). In the last fifteen years, a number of studies based on the explanation of the point/ovate divide have taken place. The debate over the main cause of variability will be considered in detail later, through a thorough examination of McPherron's hypothesis (below) and methodology (Chapter 5) but firstly it is important to examine the development of the categories of Point, Ovate and Cleaver in more detail, to assess the foundation upon which these subsequent theories are based.

3.3.1 POINTS AND OVATES RECONSIDERED

The three categories of 'Pointedness' (L_1/L) have become fully entrenched within the British scheme of working. The names 'Point', 'Ovate' and 'Cleaver' have become key elements of the major studies of handaxe variation since the 1960s (White, 1998a; McPherron, 1995). However, it is very unclear exactly what these three categories were originally intended to refer to, and what preconceptions they now engender when we read about them. The first thing to consider with Roe's (1968) metrical system is that, by necessity, the categories devised are arbitrary. The decision on what constitutes a Point, Ovate or Cleaver was made by Roe, ostensibly to create groups that separated flint points, ovates and cleavers, and is not based on an observed separation in the physical assemblages. In fact, Roe (1964; 1968) does not state in either paper why he chose those particular measurements as the range for each type. The methodology is similar to that first developed by Bordes (1961)

which divided handaxes into Triangular, Sub-Triangular, Cordiform and Discoid/Ovate, based on the location of the maximum width versus the ‘roundness’ of the edges (Maximum Width/Width at Midpoint). However, although Bordes also used the frequencies of tool types as the basis for defining distinct technological groupings such as Quina and La Ferrassie, the different types of handaxes were treated as a whole group, with the aim of creating a typology of bifacial types for the purposes of categorisation, not interpretation (Debénath and Dibble, 1994).

Undoubtedly, for both the Roe and Bordes methodologies, handaxes which fall into the middle values of each of these categories are distinct from each other, but those which fall in the outer values of each range blur the lines between groups, where 1mm can mean the difference between a Point and an Ovate. This is not to say that for the purposes of comparison these groups are not useful, yet it is clear that care should be exercised when trying to draw inferences from the distribution of these different ‘types’. As a starting point then, there is no doubt that Roe’s (1964; 1968) methodology can be used to separate assemblages into basic groupings. However, it is debatable that these groupings are related to a notion of form.

In the summary of ratios and measurements in Roe (1968) the ratio L_1/L is listed under the heading of ‘Shape’ and states that variety in this measure should be presented in the form of a frequency diagram or table ‘*to show the range of shapes in the handaxe groups*’ (pp 25). For this reason, a handaxe with a low figure for L_1/L is visualised as having a ‘pointed’ shape, with a wide base and narrower tip, and conversely a high figure for L_1/L denotes a handaxe with a wide tip and narrower base, with ovate forms falling in-between. Yet it cannot be said that the L_1/L ratio

gives any definitive statement of shape at all, rather it is a measure of the percentage of maximum length that is occupied by the ‘butt’ section of the handaxe. A figure of 0.35 for the L_1/L ratio indicates that 35% of the handaxes’ length is contained below the point of maximum width, the remaining 65% above it. Intractable aspects of raw material can impact upon the location of maximum width, as demonstrated by Figure 3.6, below:



Figure 3. 6: Wolvercote handaxe, illustrating where metrical ratios may disguise idiosyncrasies in form. This handaxe is metrically a point ($L_1=0.346$) but the shape has more to do with the raw material than any intent on the part of the knapper (Photo KE)

The shape of the handaxe pictured in Figure 3.6 is constrained by the original nodule and so the point of maximum width is artificially created. The ratio for pointedness is on the cusp of being an ovate (0.346), yet the handaxe is clearly a pointed shape overall. This also holds true for the notion of ‘Cleaver’ shaped handaxes in many cases. This has already been mentioned in passing by White (2006) who notes that, with relation to metrical cleavers, the variety of ‘shapes’ subsumed within the definition of a British ‘cleaver’ is not always identifiable using Roe (1968). This is because the position of maximum width may not be in the top 45% of the length as is required to define a metrical cleaver. This is demonstrable using the following example:



Figure 3. 7: Boxgrove handaxe, illustrating where metrical ratios may disguise idiosyncrasies in form (Photo KE)

Typo-technically (Cranshaw, 1983) this can be classed as a cleaver due to the transverse tranchet removal which has had a large effect on the shape of the tip. However, with Roe, it is classified as an ovate with a L_1/L ratio of 0.38. It has straight convergent sides, analogous to the common perception of a pointed handaxe which it quite likely was before the tranchet removal. This kind of shape would not be identified by the B_1/B_2 ratio either, although the convergent nature of the edges would be. In essence this handaxe is at once a point, an ovate and a cleaver in the tradition visual sense of these terms. This will be discussed in greater detail in

Chapter 7, where an alternative scheme for describing the ratio of butt/tip will be outlined. Before this, the following section looks at the two main hypotheses that have emerged to explain the amount of variability in handaxe assemblages which use Roe's (1968) observations as their basis: McPherron (1995) and White (1998a).

3.3.2 EXPLAINING ROE'S 'TRADITIONS'

As a result of the assignment of 'Traditions', the majority of subsequent debates on bifacial variation have hinged on the identification of these two main categories of handaxes within British assemblages (Points versus Ovates), and the reasoning behind the patterning evidenced. These groupings have become the standard shorthand through which to understand and classify handaxe variability within Britain. As such, they have become very much a case to answer in the literature, providing the framework for some of the most useful and contentious studies in the discipline. Explanations for handaxe variability have been posited on the basis of chronological development (Roe, 1968), raw material quality (White, 1995; 1998a), preferred form (Ashton and McNabb, 1994; Ashton and White, 2003), allometrical relationships (Crompton and Gowlett, 1993) and cultural types (Wenban-Smith, 2004).

Principal amongst these debates, Ashton and McNabb (1994) and White (1995, 1996, 1998a, 2003) have suggested that British Lower and Middle Palaeolithic variability in handaxe shape is governed by raw material, where the final form of the handaxe is simply a result of the initial shape and quality of the raw material. The crux of the raw material hypothesis outlined in White (1998a) is that the existence of

point- and ovate-dominated assemblages is a direct result of the quality and type of raw material available to the hominins in a particular region. White (1998a) sees ovates as a preferentially produced form, where large, good quality blocks of raw material are available, whilst points are only produced as an unavoidable consequence of using poor quality, often river-derived, narrow and elongated blocks of raw material. The basis of White's (1998a) work is that of Ashton and McNabb (1994), who proposed the theory after reconstructing the shape of original nodules from pointed and ovate handaxes. White extended this by applying their method to a larger number of samples, and concluded that Ashton and McNabb were correct. The emphasis of both pieces of research is that the difference in shape occurs because narrow, intractable pieces of raw material act in a 'conditioning' way on the actions of the knapper, forcing them to take the path of 'least resistance'; thus predetermining the outcome by precluding intensive all-round knapping (Ashton and McNabb, 1994; White, 1998). Ovate handaxes on the other hand are 'unconditioned' and allow the knapper to create a handaxe in '*whatever shape they desired*' (White, 1998a, 17). White believes that the production of handaxes in ovate forms is a reflection of a generalised mental construct, leading hominins to create, where possible, ovate handaxes with continuous sharp edges and a high level of symmetry.

White (1998a) asserts that, from the examination of handaxe assemblages from 19 British sites, '*final handaxe shape depends largely on the dimensions of the original raw material*' (15) combined with the knapping strategies used to create them. He cites Roe's (1968) typology as '*dividing handaxes into three metrically-defined shape classes*' (15) but accepts that this did subsume large amounts of variation, but again defines points and ovates as distinctive shape-classes.

Ashton and McNabb (1994) recognise that modern researchers have their own 'mental template' of what a handaxe is. They challenged the notion that handaxes were symmetrical objects with distinct butts and tips, created by bifacial thinning with a specific design in mind. Instead they posit a continuum of bifacial form, from classic to non-classic. However, they also refer to ovate and pointed handaxes as 'shapes,' despite acknowledging that the basis for the terms is an arbitrary division of the relative location of the maximum width ratio.

Further indications of the potential complexity of the issue have come from McPherron (1994, 1995, 1999, 2003) who contends that his study of handaxes from Britain and France indicates that handaxe shape changes from point to ovate as the tip of a handaxe is sharpened. This process takes place over several episodes of use, resharpening and reuse. McPherron (1994), a student of Dibble (1987), applied a paradigm to the question of handaxe variability which had enabled a wider understanding of Mousterian variability. Dibble's analytical framework sought to determine whether variation in inter-assemblage tool form could be explained in terms of resharpening and reworking of tools. Dibble (1987) proposed that variation in scraper morphology in French Mousterian assemblages was due to the constant rejuvenation of scraper edges through retouch. McPherron (1995) established a direct relationship between handaxe tool form and size at Cagny-la-Garenne/Gouzeaucourt (1999) and Tabun (2003).

The aim of the following discussion and analysis is to examine this debate, mainly from the examination of McPherron's (1995) theories as his calculations and hypotheses are more readily replicated and critiqued than White's (1998a).

Having established that there was a link between resharpening and tip length in French handaxes (1994), McPherron (1995) applied Dibble's (1987) theory to British handaxes. Figure 3.8a shows how theoretically a point can be reduced into an ovate through reduction of the tip. The measure of Tip Length is central to the calculations, and is obtained by subtracting L_1 (distance from the base to the point of maximum width) from L (Length) (Figure 3.8b(i)/(ii)). Therefore, the resharpening of the tip results in an overall change in shape which, it is asserted, explains the variability in British bifacial assemblages.

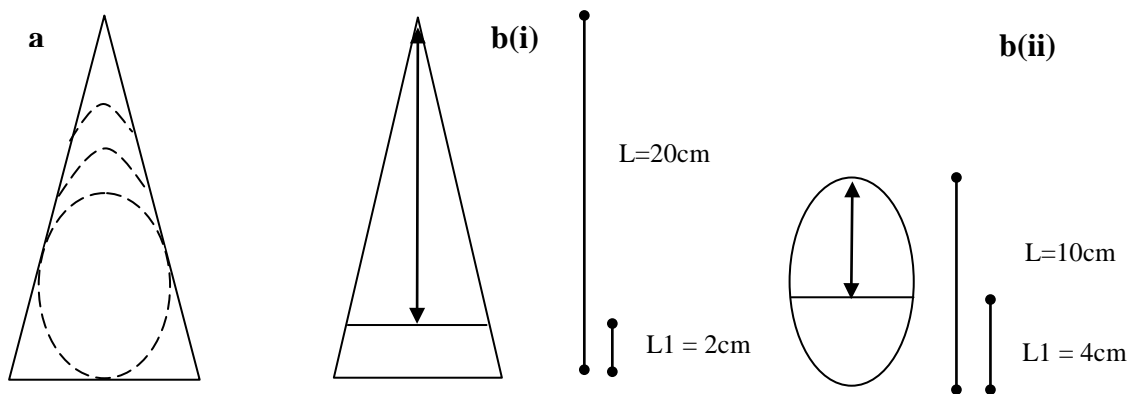


Figure 3. 8: A diagrammatic representation of a) a point being reduced into an ovate by resharpening of the tip and b) a point (i) and an ovate (ii) with tip length being indicated by the arrow.

Type	Length (cm)	L1 (cm)	Tip Length (cm) (L-L1)
Point - b (i)	20	2	18
Ovate - b (ii)	10	4	6

Table 3. 5: Summary of the measurements from Figure 4.6 – illustrating how Tip Length is calculated.

Figure 3.8 and Table 3.5 illustrate the key principles of McPherron's (1994) hypothesis. It should be noted that, given the concerns noted earlier regarding the lack of a relationship between 'Pointedness' and actual handaxe shape, McPherron (1995) is aware that the L_1/L ratio does not relate to overall shape, but demonstrates that there is a correlation between the average edge shape (B_1/B_2 - the width at $1/5^{\text{th}}$

and 4/5th of the length) for each assemblage and the average figure for 'Pointedness'. Given that McPherron (1995) relates his schema to the notion of the Pointed and Ovate shapes, the diagrams above were drawn with traditional ideas of these shapes in mind.

McPherron (1995) analysed Roe's (1968) data using his resharpening methodology and concluded that the application of the terms Point, Ovate and Cleaver were subsuming a large amount of variation, particularly within assemblages. The main dimensions of handaxe shape were being affected by resharpening and those that were affected most depended on the intention of the knapper. McPherron (1995) then subjected the British dataset to a substantial statistical analysis to look for significant correlations between variables. Surprisingly, despite noting the large amount of variation present within assemblages, he used an average figure for all sites under the 'Pointed Tradition' label to compare with a matching average figure for the 'Ovate Tradition' sites. He found a significant difference between the two traditions on the basis of refinement, with Ovate Tradition handaxes being more refined. This was combined with Pointed Tradition handaxes being more elongated. Ovate Tradition handaxes also had shorter Tip Lengths than Pointed Tradition handaxes.

McPherron concludes that Tip Length is the key factor that divides British handaxes into two groups, those with shorter tip lengths that are broader and thinner than those with longer tip lengths which are narrow and relatively thick. He extrapolates this to infer that handaxes with long tips are reduced down into those with short tips. McPherron (1995) concedes that there is a relationship between his patterning and the raw material type used predominantly at the site, however he sees the two positions as complementary. White (1998a) however, does not see the relevance of

McPherron's (1995) resharpening model and believes that raw material is the major influence on handaxe shape. The results of White's (1998a) analysis are outlined briefly below.

3.3.4 THE RAW MATERIAL HYPOTHESIS

To demonstrate the relationship between raw material and handaxe shape, White (1998a) collected his own original data from a number of sites in southern Britain and found that there was a relationship between the dominant form in an assemblage and the raw material it was made on. He took this further to demonstrate that in point-dominated assemblages, 22-35% of all handaxes were made on conditioned blanks (those where the raw material influenced the shape of the handaxe), this figure not exceeding 5% in the majority of ovate assemblages. This was combined with the finding that 74% of identifiable conditioned blanks were made into points. White also identified a further factor in the production of handaxes, the fact that raw material could have passive or active conditioning, with the latter forcing the outcome of knapping, the former merely suggesting the path of least resistance. This led to a 'least effort' policy with the aim of maximising long, sharp edges.

White (1998a) also explicitly acknowledges that there is large amount of variation subsumed within the bimodal division of Ovate and Pointed Traditions but also refers to each Tradition as a shape-class. It is therefore possible to see these results as referring to the distinction between two groupings differentiated by shape in the traditional format. White (1998a) found that, in general, Ovate handaxes were more intensively reduced around the whole circumference than pointed handaxes, with

higher flake counts and less residual cortex. Pointed handaxes had increased thinning on the tips, with butts left unworked to retain balance and prehensile qualities.

White believes that the creation of Ovates rather than Points from large pieces of raw material reflects the ability to weight Ovates in the centre, the production of an all-round edge and the differential motion achieved by holding the handaxe in the centre, as opposed to the end-held sawing motion produced with points. The overriding factor in the creation of Ovate- and Point-dominated assemblages was the proximity to raw material, with the nearer source used preferentially regardless of quality, and sites with no local sources containing imported fresh flint.

Both McPherron (1999; 2000; 2006) and White (2003; 2006) have continued to revise and refine their theories, particularly in relation to each another. To attempt to put the continuing debate between McPherron (1995) and White (1998a) into context, the following is a review of the main critique of the resharpening hypothesis by Ashton and White (2003).

3.3.5 EXISTING CRITICISMS OF THE RESHARPENING HYPOTHESIS

Ashton and White (2003) reasserted their claim that raw material was the primary cause of handaxe variability partially through the criticism of the resharpening hypothesis, which can be condensed into four main points.

Firstly, Ashton and White (2003) contend that by looking at the relative dimensions of ovates and points in a single assemblage it can be demonstrated using the midpoint that ovates have wider midpoints than points and therefore cannot have been manufactured from points:

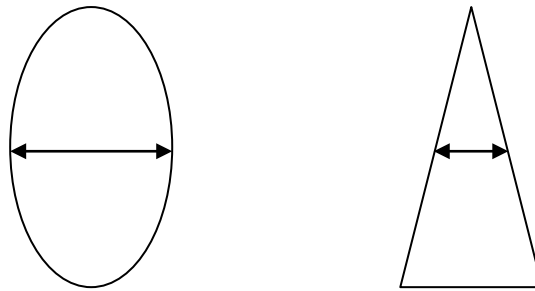


Figure 3. 9: Diagrammatic representation of an ovate with a wider midpoint than a point.

However, to my mind, there is a central fallacy to Ashton and White's (2003) argument: if an ovate were created from a point, the midpoint of the new handaxe may not be in the same place as that of the original point. This is illustrated in Fig. 3.10.

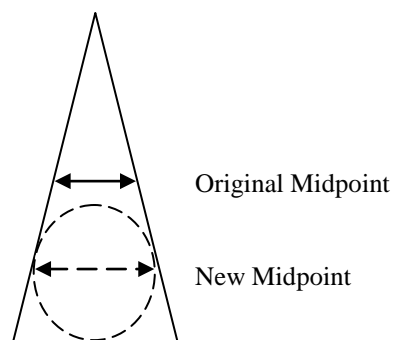


Figure 3. 10: Diagrammatic representation of an ovate that has been created from a point with a wider midpoint than the original handaxe.

This shows how the original midpoint 'moves' and the new midpoint of the ovate is actually wider than that of the point. Therefore it is not possible to critique the McPherron argument (1999) using this assertion, although it would be possible to test this through experimental replication.

Secondly, Ashton and White (2003) argue that there are both ovate and pointed roughout shapes found within assemblages, particularly those from Boxgrove. This is said to illustrate that both pointed and ovate handaxes were made from the initial roughing out stage. Whether this is a convincing argument depends on whether it is more likely that an ovate-shaped roughout would be made into an ovate and pointed roughout into a point. If roughout shape is contingent primarily on raw material shape, then roughout shapes would be independent of actual handaxe shapes: however, if the knapper is the determining factor then it seems likely that the shape of the roughout has been deliberately shaped into a desired form. The notion of preferred shape is still contentious, with opponents such as Gamble (2001) suggesting that the route of 'least resistance' is more likely to have guided the hand of the knapper than any preconceived notion of final outcome. It is difficult to resolve this argument using the data available. Short of demonstrating actual examples where it can be shown through a complete reduction sequence that a knapper has not taken the path of least resistance in order to make a certain shape of handaxe, it is not possible to take a definitive stance on this issue.

Thirdly, the most conclusive counter-argument to the resharpening hypothesis from Ashton and White (2003) is the demonstration that an ovate was created from the product of a single knapping sequence (Ashton and White, 2003). This is seen at Boxgrove, in the reconstruction of a complete knapping sequence, from nodule to handaxe, where the outcome of the manufacturing process was an ovate, not a point. The knapping sequence was recovered from a single-episode butchery event where a handaxe had been fashioned on the spot for an immediate need using local raw material. It is difficult to imagine any argument that would counter this assertion, other than that it is a unique occurrence.

Another argument which may be posited is that if the length of ovate handaxes is greater than that of the points in an assemblage, then it is not possible that the ovates were reduced from pointed handaxes. However, utilising a combination of McPherron (1995) and Shott (1996) this notion can be dismissed as by McPherron (1995) the ovates represent reduced points, therefore larger pointed handaxes have been reduced into ovates, obliterating any trace of them. The smaller points are at an earlier stage of their use-life, and as such have been discarded before substantial reduction. Any differences in size are therefore related to the initial size of the raw material they were created on.

Finally, data from Roe's published sources (1968) is utilised by McPherron (1999) as evidence to support his hypotheses in the form of raw material availability. Both White (1998a) and McPherron agree that pointed handaxes are most often found discarded in the immediate vicinity of their raw material sources, with ovates often being found away from their source. Both also agree that this is because of transportation of handaxes away from sources of raw material through the landscape. Where the interpretation differs is that McPherron (1999) sees pointed handaxes being removed from sites and rejuvenated into ovates during transportation, whereas White (1995) sees ovates being preferentially removed and transported as they are made from better quality raw materials than the pointed handaxes. Boxgrove again provides a counter-argument to McPherron (1995), as it is an ovate-dominated site with immediate access to large amounts of good raw material (Roberts and Parfitt, 1999), supporting the White (1998a) hypothesis.

The outcome of this particular debate is central to the wider understanding and interpretation of variability in British handaxe assemblages. In order to assess the

relative positions of Ashton and White (2003) and McPherron (1995) it is necessary to further review the McPherron hypothesis. One aspect of the resharpening theory that was not explored fully by Ashton and White (2003) is the basic measurements and assumptions upon which the theory is based.

3.3.6

MEASURING RESHARPENING

McPherron (1994; 1995) illustrated variability in handaxe form by comparing three different measures to the Tip Length - Relative Location of the Maximum Width, Elongation and Refinement. The salient points of these measurements are presented below.

RELATIVE LOCATION OF THE MAXIMUM WIDTH (PLANFORM)

The first measurement, ‘Relative Location of Maximum Width’ (RLoMW/Planform) is identical to Roe’s (1968) measurement of ‘Pointedness’. The value is calculated by dividing the distance between the base and the point of maximum width (L_1) by length (L) (Fig. 3.11).

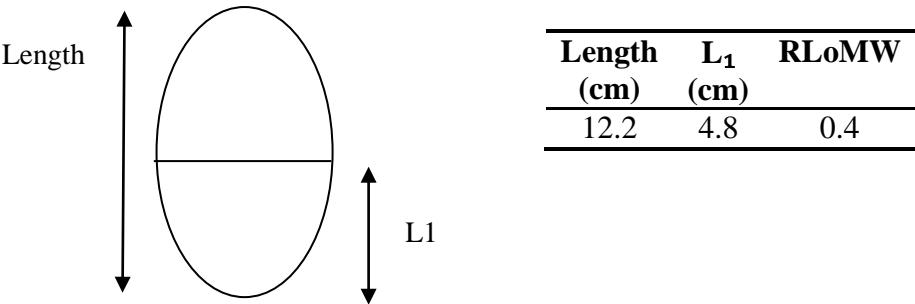


Figure 3. 11: Illustration of the calculation of Relative Location of the Maximum Width.

This calculation was used by Roe to determine whether a handaxe was an ovate, point or cleaver as outlined above (for example: in Figure 3.11 the handaxe is an ovate). McPherron's expected pattern for this measure is that handaxes that are metrically defined as points ($RLoMW \leq 0.351$) have the longest tip lengths and that, as tip lengths decrease, handaxes become more ovate ($RLoMW \geq 0.350$). A perfect correlation produces the following graphical pattern:

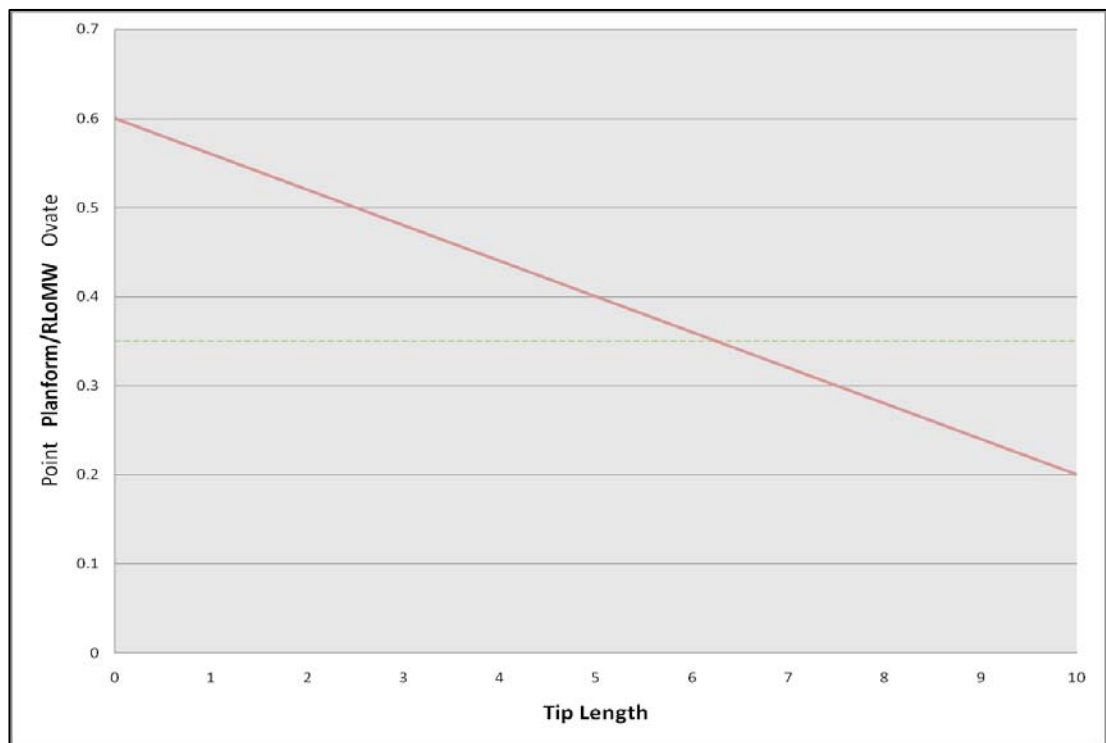


Figure 3. 12: Idealised correlation between Tip Length and RLoMW (adapted from McPherron, 1995).

ELONGATION

'Elongation' is also taken from Roe (1968). It is the measure of length in proportion to width. Width (W) is divided by Length (L) so as to produce an Elongation Index. A figure of 0.5 would indicate that the width was exactly half the length, with any figures higher than this indicating a width that is more than half the length and vice versa (Figure 3.13).

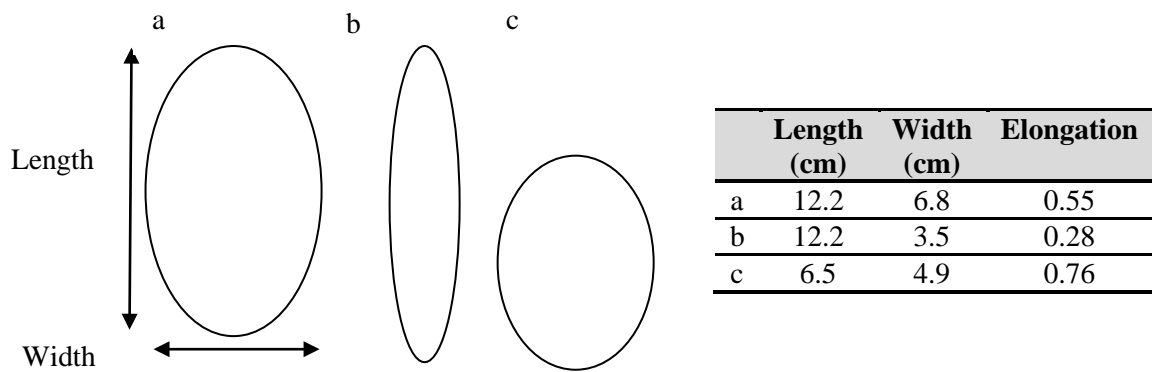


Figure 3. 13: Illustration of the calculation of Elongation using three different examples.

A high elongation figure (i.e. above 0.5) actually indicates a wide handaxe with low elongation, (for example: c in Figure 3.13, above). McPherron's (1995) expectation is that, as a handaxe has its tip reduced, the width will increase in relation to the length (Fig. 3.14).

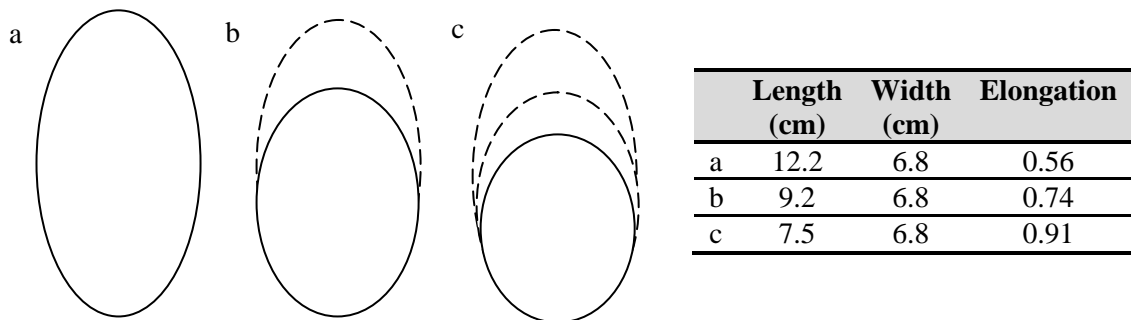


Figure 3. 14: Illustration of how elongation changes as tip length is reduced..



Figure 3. 15: Examples of handaxes with a low (Cuxton) and high elongated index (Le Moustier) (Photos: KE)

Therefore, handaxes with small tip lengths will be less elongated (high elongation index) than those with longer tip lengths will be more elongated (low elongation index). This would produce an idealised graphical representation as follows:

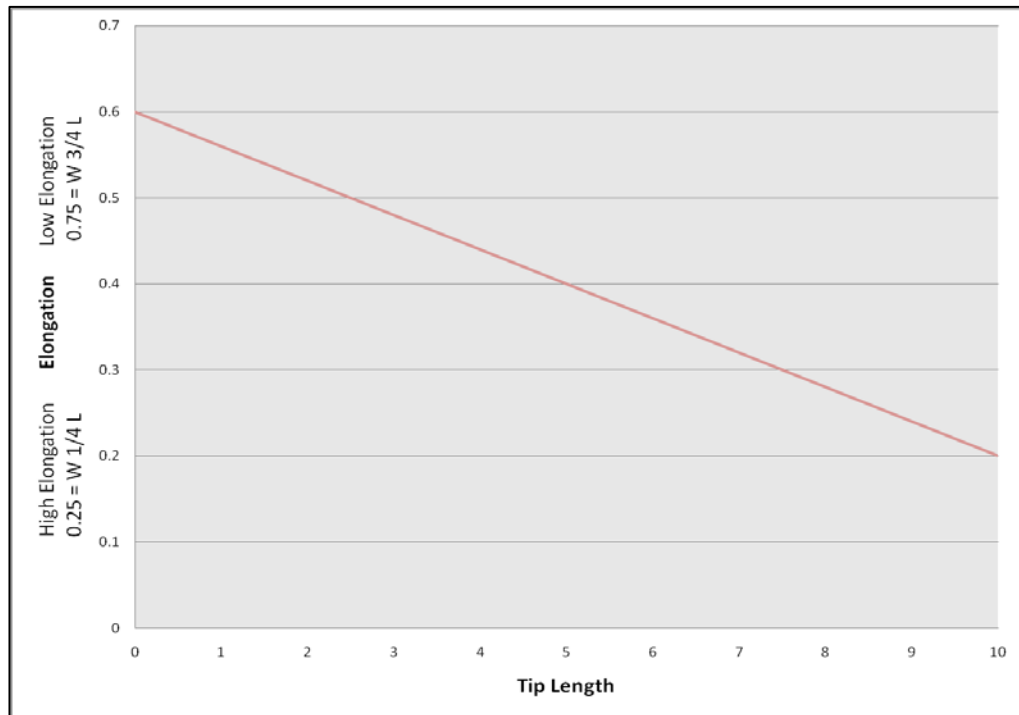


Figure 3.16: Idealised correlation between Tip Length and Elongation (McPherron, 1995).

REFINEMENT

When McPherron (1999) compared the Cagny La Garenne and Gouzeaucourt handaxes, 'Refinement' was the only measure that showed a significant difference between the two assemblages. Refinement is the measure of width (W) relative to thickness (Th), the latter being divided by the former. The higher the value of refinement, the thicker the handaxe is compared to its length (Figs. 3.17 and 3.18). Higher refinement (lower values) is generally seen to be a result of more intensive thinning and resharpening.

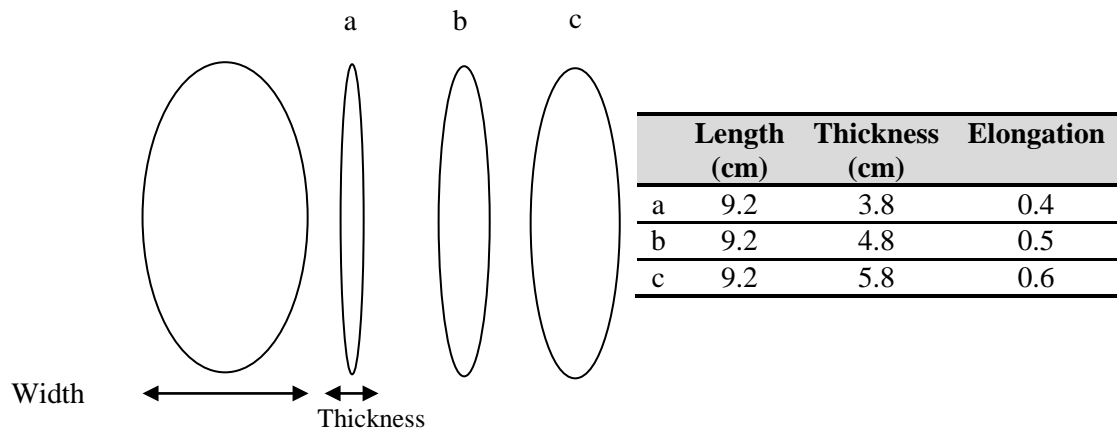


Figure 3. 17: Illustration of the calculation of Refinement using three different examples



Figure 3. 18: Examples of handaxes with high (Boxgrove) and low (Cuxton) refinement (Photos: KE).

When McPherron plotted refinement against tip length he expected that the shorter tip lengths would correspond with the greatest refinement, yet the data showed contrasting patterns. Handaxes from Cagny La Garenne corresponded to expectations but handaxes from Gouzeaucourt exhibited short tip lengths and low refinement values. McPherron (1999) interpreted the expected pattern of short tip lengths and high refinement as an assemblage in the early stages of reduction, when more thinning leads to a decrease in the thickness of a piece and the tip lengths are relatively long. The opposite pattern of short tip length and low refinement reflects an assemblage in the later stages of reduction, where the handaxes reach a ceiling

beyond which they cannot be thinned any further. This leads to an increase in thickness relative to length as they become more reduced. These patterns would be represented graphically as follows:

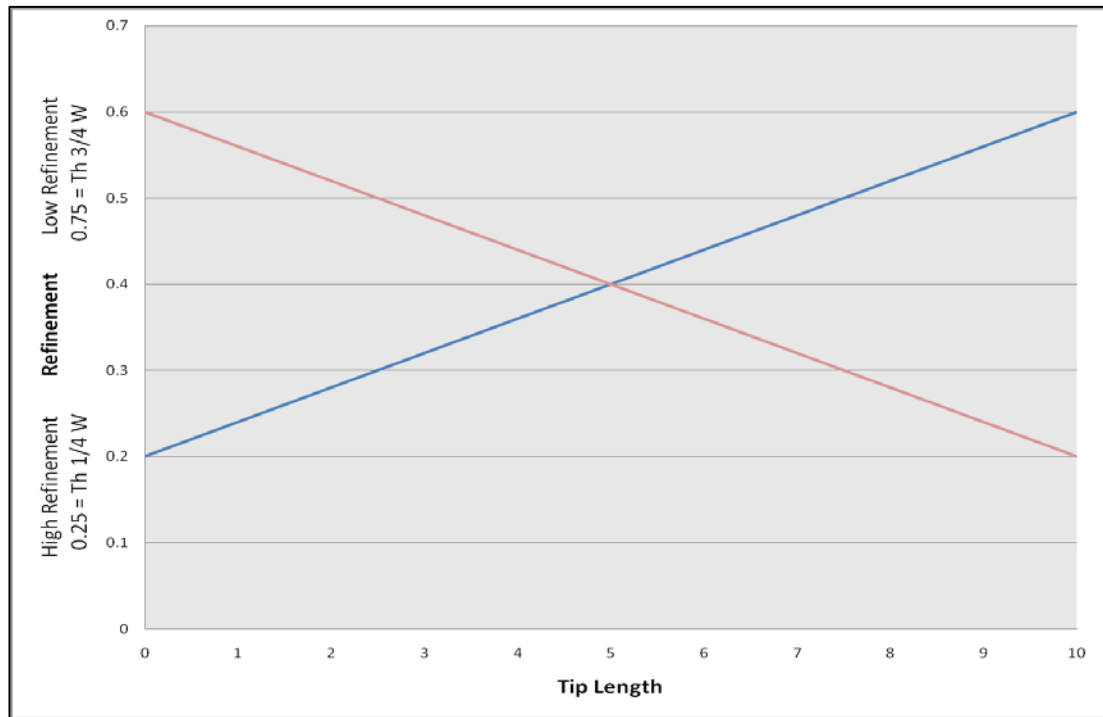


Figure 3. 19: Idealised correlation between Tip Length and Refinement (adapted from McPherron, 1995).

3.3.7 MCPHERRON SUMMARY

Table 3.6 summarises the review conducted above:

Measure	Calculation	Expectation
Relative Location of the Maximum Width (Planform)	L1/Length	That low values for RLoMW will have high values for Tip Length (TL) and vice versa. This indicates that Ovates have smaller TLs than Points.
Elongation	Width/Length	That high values for Elongation will have low values for TL and vice versa. This indicates that handaxes that are long compared to their width (narrow, elongated) will have longer TLs than handaxes that are wide compared to their length (wide, not elongated).
Refinement	Width/Thickness	Both patterns are possible and have different implications. Handaxes will either have high Refinement values and low TL values (and vice versa) or high Refinement values and high TL values (and vice versa).

Table 3. 6: Summary of the key components of McPherron's (1995) Hypothesis.

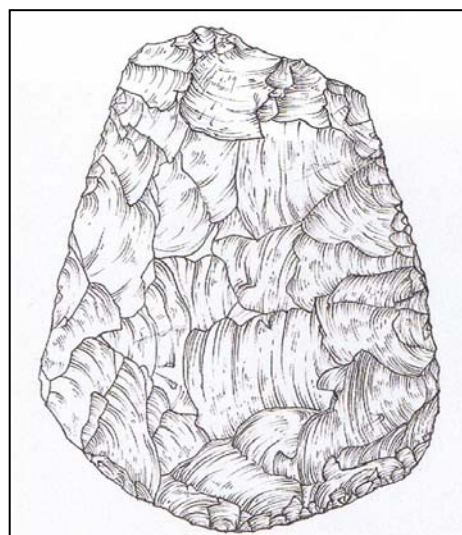
Using these measurements, it is possible to compare McPherron's (1995) expected correlations with the actual patterns produced using the data collected for the purposes of this study. From this comparison, the basis for McPherron's (1995) assertions and their applicability to the British handaxe data can be assessed. Resolving the raw materials versus sharpening debate will be the first step towards the explication of bifacial variability and will form a useful analogy for any subsequent data analysis. This study proceeds by attempting to utilise the insights gained from this discussion, through the examination of both the Roe (1968) and McPherron (1995) schemes, facilitated by the analysis of original data using their methodologies (Chapter 5).

3.4

SUMMARY

The preceding chapter has attempted to show that Roe's (1968) search for objectivity in handaxe typology was certainly laudable and was a genuine attempt to distance lithic researchers from subjective assignments of chronology and typology based solely on observation. As a metrical method of recording data, it is seemingly built on the work done by Bordes (1961) on European lithic technology, and provided a classificatory scheme for distinguishing between different types of handaxe groups on the basis of a set of measurements and ratios. There is no doubt, that for this purpose, there is still room in British lithic studies for Roe's (1968) scheme of measurement, especially as it provides a basis for comparison between datasets as a standardised way of measuring.

What remains to be demonstrated however, is the practicality of basing explanations of handaxe variability on the division between ovate and pointed forms. The above discussion has suggested that the division itself is arbitrary, can be influenced by intractable raw material and may not be capable of metrically distinguishing all of the variations in shape that exist within the British lithic dataset. This discussion proceeds with the testing of Roe's methodology on an original dataset of Lower and Middle Palaeolithic handaxes, both to look at the patterns visible within the dataset and to look at the possibilities and limitations afforded by the methodology. This is followed by an in-depth examination of McPherron's (1995) resharpening hypothesis, particularly with the notion of the limitations of Roe's (1968) methodology in mind. Firstly it is necessary to introduce the sites used in the following analysis. In Chapter 4, each site is outlined with relation to its historical and geological context, alongside a description of the faunal, flora and lithic artefacts recorded. This is supplemented with a justification for the sites' inclusion in the analysis. Through this, it will be demonstrated that there are a wide range of sites from different periods, climatic conditions and geographical locations which can be compared to assess the underlying cause of handaxe variability.



CHAPTER FOUR: SITE SUMMARIES AND CLIMATIC CHRONOLOGY

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In the opening chapter, the emphasis of the study was placed upon examining variability through the collection of original data. Chapter 2 outlined the current state of discussion and identified the possible factors controlling variability which could be accessed through this data. Chapter 3 introduced the basis of the key studies of handaxe variability and this will be tested further in Chapter 5. This chapter is designed to introduce the sites used in the subsequent analysis; giving a summary of the location, environmental evidence, assemblage characteristics and the role that each site plays within the research. This information is also summarised at the end of the chapter. The sites are organised into a rough division of period for the sake of clarity. Due to disparities in the quality and quantity of the investigation, recording and subsequent publication of the sites recorded, there are substantial differences in the length and detail of the descriptions. The following section outlines the geographical distribution of the sites and tabulates them with regard to period and technology.

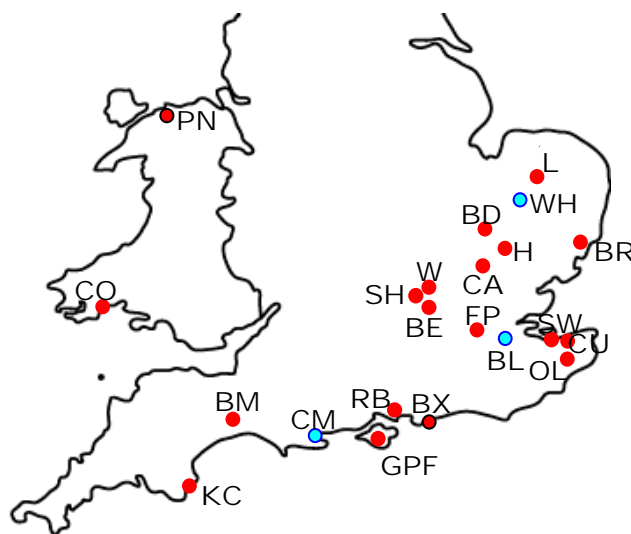


Figure 4. 1: Location map showing sites studied. Blue dots indicate sites where data is taken from the ADS database (Marshall *et al*, 2002).

Period	MIS	Date (k BP)	Technology	Sites	Technological Feature	Handaxes Recorded	Major References
Early Lower Palaeolithic	13 Cromerian	500-480	Acheulean	Boxgrove (BX) Warren Hill (WH)	Assemblages dominated by handaxes;	183	Roberts <i>et al</i> (1997) Roberts and Parfitt (1999)
	12 Anglian	480-430			Faconnage technique of manufacture dominant;	636	Solomon (1933) Roe (1968)
	11 Hoxnian	430-380	Acheulean	Hitchin (H) Swanscombe (SW)	Twisted handaxes (MIS 11).	25	Reid (1897) Boreham and Gibbard (1995)
	10	380-320				112	Wymer (1964) Conway <i>et al</i> (1996)
Late Lower Palaeolithic	9 Purfleet	320-290	Acheulean	Furze Platt (FP) Red Barns (RB) Wolvercote (W)	Similar to above; At Wolvercote – side struck flakes and plano-convex handaxes	1667	Lacaille (1940); Bridgland (1994)
	8	290-230	Acheulean	Broom (BM)	Earliest evidence for Levallois;	5	Gamble and ApSimon (1986) Wenban-Smith (2000)
	7 Aveley	230-180	Late Acheulean / Levallois	Pontnewydd (PN) Great Pan Farm (GPF) Stanton Harcourt (SH)	Handaxes and Levallois side by side – neither co- exist in large	75	Sandford (1924); Tydesley (1986)
	6	180-130			Britain cut off from mainland France in 5e – no population indicated;	1804	Green (1988); Hosfield and Chambers (2002)
Middle Palaeolithic	5e Ipswichian	130-118				32	Green <i>et al</i> (1987);
Late Middle Palaeolithic	4 Early Devensian	74-60	Mousterian	Lynford (L) Kents Cavern (KC)	MTA A assemblages dominate; Large handaxe component;	49	Poole (1925); Shakley (1973)
	3 Middle Devensian	60-28	Mousterian	Coygan (CO) Bramford Road (BR)	Bout coupé handaxes.	49	Hardaker (2001); Scott and Buckingham (2001)
Undated sites: Biddenham (BD) (MIS 9-11), Cuxton (CU) (MIS 8-11), Caddington (CA) (7-11), Corfe Mullen (CM) (7-13), Bowman's Lodge (BL) (9-11), Berinsfield (BE) (9-7) Oldbury (4-3)							

Table 4. 1: Summary of sites studied according to periods, sites and technology

Table 4.1 gives a clear outline of the distribution of sites in the study, in terms of chronology and technology. A broad indication of MIS is combined with an overview of the prevalent technology. Figure 4.1 gives a distribution map of the sites, using the abbreviations noted in Table 4.1. As demonstrated by Figure 4.1 and Table 4.1 the sites are well distributed both geographically and temporally. This is ideal for the investigation of bifacial variability with regard to the hypotheses outlined at the end of Chapter 2.

4.3 EARLY LOWER PALAEOLITHIC

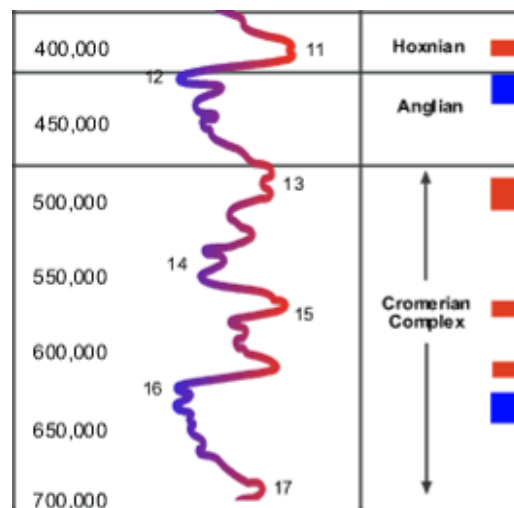


Figure 4. 2.: Marine Isotopic Curve showing the major climatic fluctuations in MIS 13-11, together with the British Stages (adapted from AHOB website).

The Early Lower Palaeolithic (ELP) encompasses the timescale from 500,000 to 380,000 BP (MIS 13-11), incorporating the earliest occupation of Britain by handaxe-making hominins. Although there is now evidence for earlier sporadic occupation of the British Isles in Marine Isotope Stage (MIS) 17 (700,000 BP) at Pakefield (Parfitt *et al*, 2005), the artefacts discovered there are characteristic of a non-bifacial technological suite. Therefore, there is no artefactual evidence that groups of handaxe-bearing hominins reached Britain before 500,000 BP.

4.3.1 MARINE ISOTOPE STAGE 13 – END OF THE CROMERIAN COMPLEX

The scope of the Cromerian period as referred to in this study, is restricted to the final stage of the Cromerian (MIS 13) when the earliest evidence of Acheulean tool-making hominin populations in Britain is found (Roberts *et al*, 1997). MIS 13 is dated to approximately 500,000 - 480,000 BP and is representative of a global temperate stage (Lowe and Walker, 1997). It is a period of positive isotopic value, indicative of low sea levels (Shackleton *et al*, 1990, 1998). Encompassed within Cromerian Complex of sediments there are four recognised stages, CrI to CrIV (Zagwijn, 1996). Occupation at Boxgrove is related to CrIV, immediately preceding the Anglian glaciation (MIS 12) (Roberts and Parfitt, 1999). Evidence of British Cromerian climate comes mostly from marine and freshwater sediments in cliff sections on the coast. West Runton, Norfolk is the type-site for the Cromerian and is representative of a fully interglacial cycle. Cromerian-age alluvial sediments at High Lodge contain floral and faunal remains that are also indicative of temperate conditions (Jones and Keen, 1993). The table below lists a summary of Cromerian fauna and representative habitats:

Species	Habitat
Fallow deer, roe deer, wild boar	Temperate forest
Giant deer, elk, horse, rhinoceros	Open habitats
Leopard, cave bear, sabre tooth tiger	Cave
Beaver, water vole, birds, ducks	Aquatic conditions

Table 4. 2: Cromerian-type fauna with associated habitats. After Jones and Keen (1993)

4.3.2 BOXGROVE, CHICHESTER, WEST SUSSEX (SU 920 085)

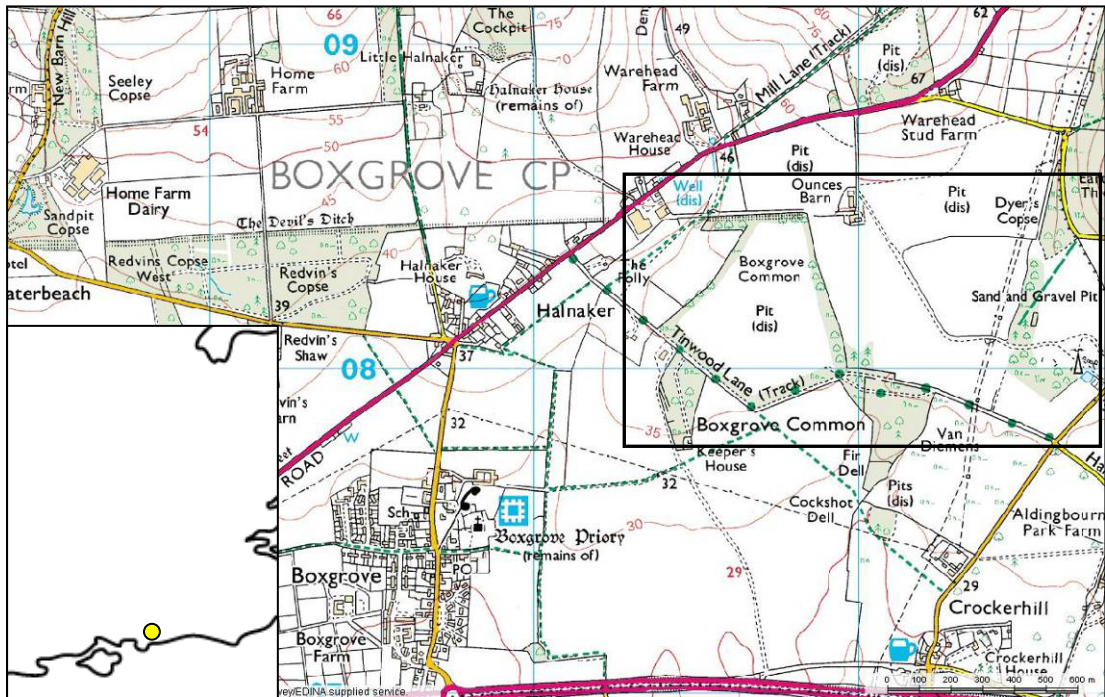


Figure 4. 3: Map of the present-day Boxgrove site (Inset - South Downs and South Coast). © Crown Copyright/database right 2007. An Ordnance Survey/EDINA Digimap supplied service.

Introduction: Boxgrove is the key site for this period, representing the one of earliest Acheulian sites in Britain. It is situated on the junction of the South Downs and the West Sussex coastal plain in Southern Britain and is dated to c.475,000 BP. Excavations at Amey's Eartham Pit from 1984 to 1996 produced an extensive assemblage of Acheulian handaxes, debitage and other lithics, including refitting scatters, together with a large faunal assemblage and hominin remains attributed to *H.heidelbergensis*.

Geological and Stratigraphic Context: Investigations of Boxgrove sediments indicated that the site experienced a range of conditions during MIS 13 from fully marine to terrestrial. The Slindon Formation related directly to the formation of the hominin inhabited landscape, with the Slindon Sands and Gravels (Units 1-3) representing a collection of marine and littoral deposits that were deposited during

multicyclic marine transgressions that reached to the base of the South Downs. Subsequent to this, a marine regression led to the creation of an offshore bar, and a low energy, lagoonal environment was created (Figure 4.5), depositing the Slindon Silts (Units 4a and 4b). At the top of this unit, marine deposition ceased, allowing the formation of a soil where the main unit of archaeological remains are now found (Unit 4c). Although Boxgrove was experiencing marine and coastal conditions at this time, the South Coast was only separated from the French mainland in part. It has been determined, from sedimentary records, that Britain was connected from Kent to Calais by a land bridge (Gibbard, 1995) (Figure 4.6) and so would not have experienced full isolation even at the peak of the interglacial (Bates *et al*, 1998; Roberts *et al* 1996, 1999).

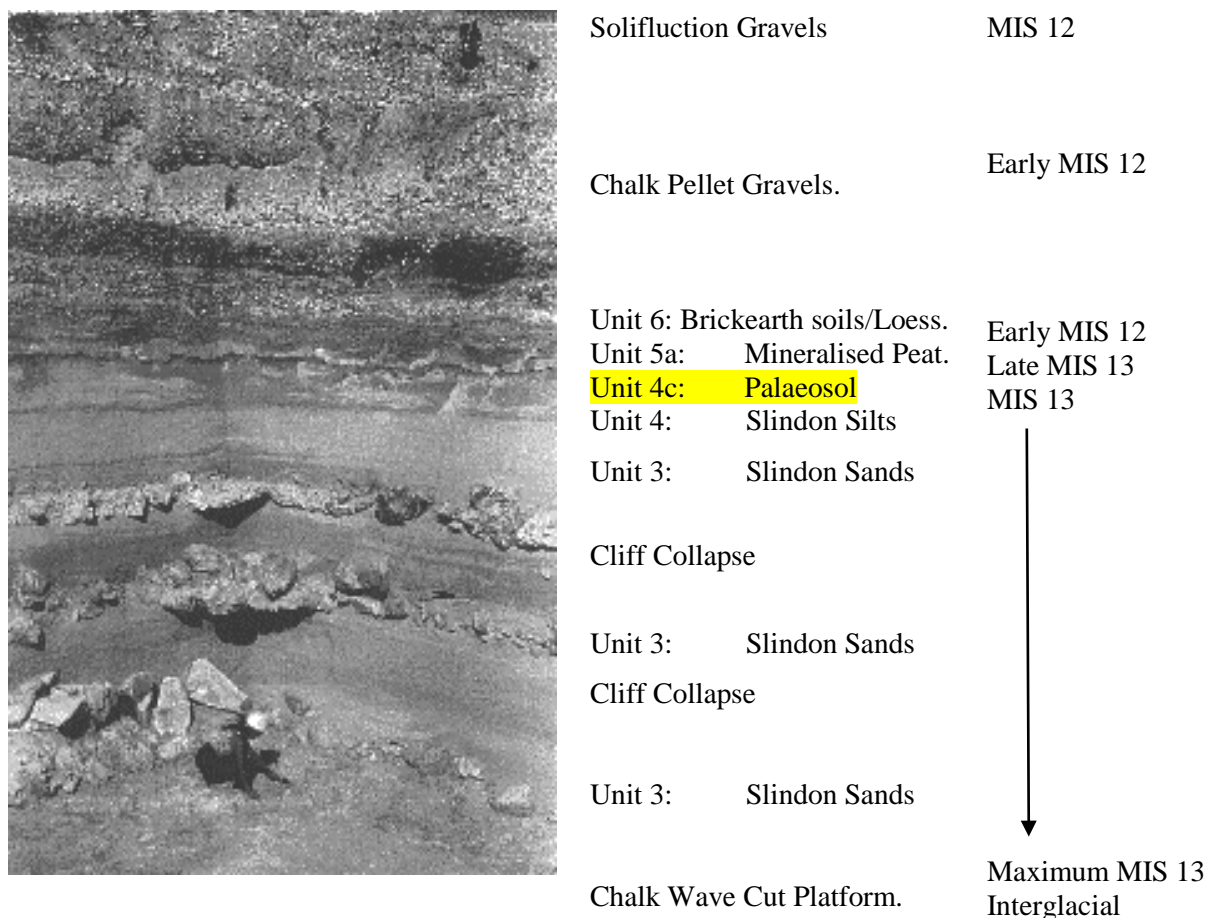


Figure 4. 4: Stratigraphic diagram of the Slindon Formation (Pope, 2002). Unit 4c is highlighted as the main archaeological horizon, although artefacts were found throughout the sequence.

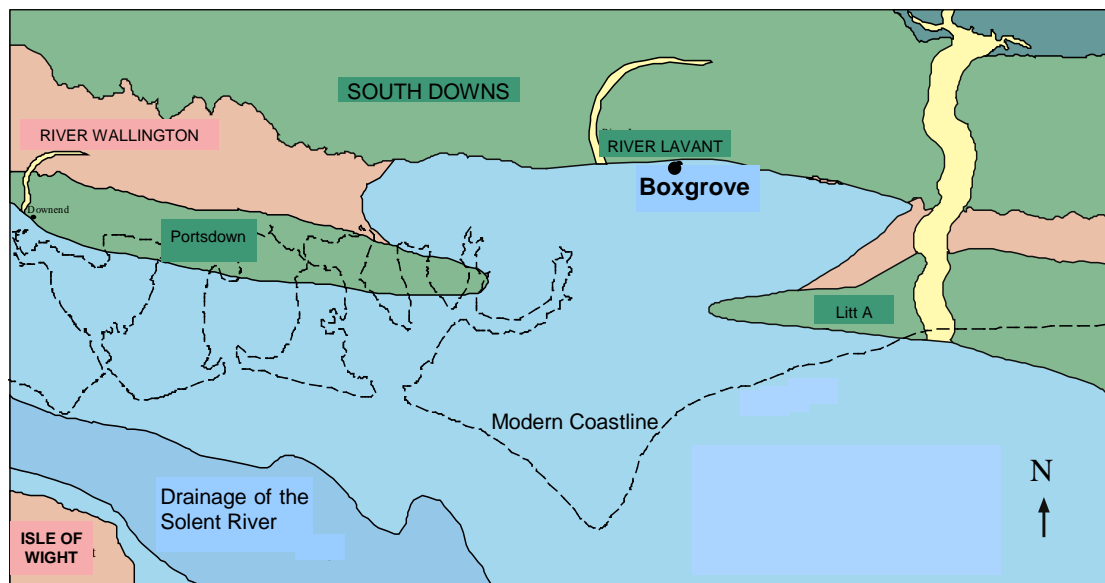


Figure 4. 5: Diagrammatic recreation of the estimated coastline in MIS 13. After Pope, (2007)

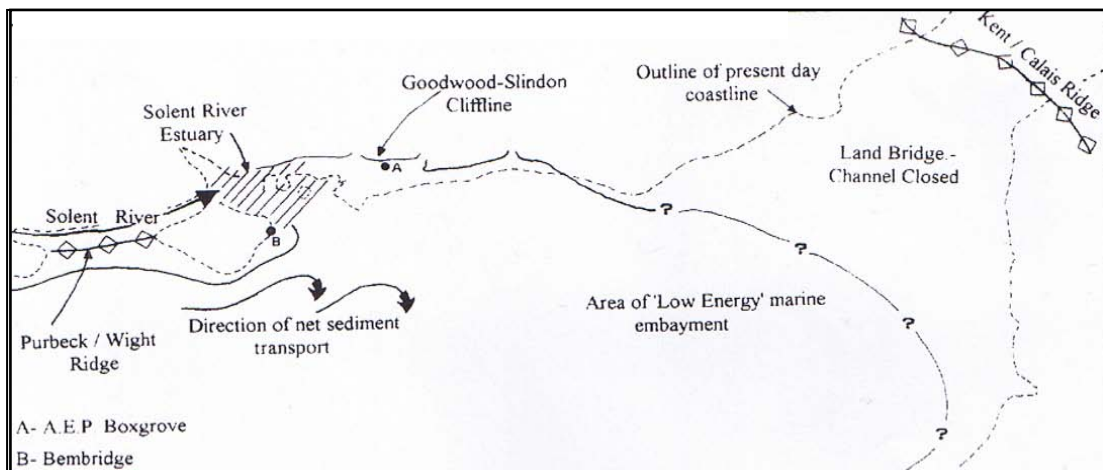


Figure 4. 6:- Reconstruction of the Kent-Calais landbridge (Bates *et al*, 1997, 1245)

The deposition of the landsurface at Boxgrove (Unit 4c) took place over a maximum of 100 years, providing a unique opportunity to make inferences about short-term patterning in hominin behaviour (Roberts and Parfitt, 1999).

Environment, Flora and Fauna: When the site was occupied by hominins, the local environment is believed to have been the foreshore of a large embayment, at the base of a large chalk cliff (Figure 4.5). The species of fauna present at Boxgrove indicate an environment of dense scrub or woodland with open grassland in the immediate

vicinity of the site. It is thought that the small mammals present on the site are most likely to have been introduced by carnivores. Butchered red deer and bovid remains give some indication as to the type of animals hunted or scavenged by hominins and are complemented in the faunal record by great auk, roe and deer. The pollen record for the site is sparse and inconclusive but indicates pine woodland to the north of the site (Roberts *et al*, 1997).



Figure 4. 7: Three examples of finely made Q1/B Boxgrove handaxes (Photo: KE, illustration courtesy of M.Pope)

Lithic Assemblage Potential and Rationale: Detailed reconstructions of the local landscape and prevailing environmental conditions allow the artefacts to be placed within a context of manufacture. The handaxes are amongst the most refined collection in the British Palaeolithic (McPherron, 1995) and are a testament to the possibilities afforded by a substantial supply of good quality local raw material. The assemblage provides an opportunity to study the processes of manufacture under such conditions, examining whether limitless possibilities produce substantial variation in output. Boxgrove handaxes were primarily manufactured through the reduction of a large nodule of material to create a handaxe roughout. This was then shaped and finished into the final handaxe form, a process labelled '*façonnage*', distinct from the '*debitage*' method of reduction where flakes are the intended

production of the reduction process. The assemblage from Boxgrove forms a part of White's (1995) analysis, where he characterises it as a perfect exponent of the unconditioned handaxe hypothesis (Ashton and McNabb, 1994) as it has predominantly ovate, well-refined handaxes produced entirely on locally derived fresh flint.

Data Collection: The assemblage from Quarry 1/B is the focus of the study at this site. Q1/B became the single largest excavation project undertaken at Boxgrove and involved the detailed recovery of 20,000 lithic artefacts, 3000 pieces of fauna and environmental evidence from 13 sedimentary units (Pope, *in prep*). The vast majority of the investigation of this area is yet to be published. Data from Boxgrove used in this dissertation consists of 30 flint handaxes measured by hand (located in the British Museum – Franks House) and 153 in the form of metrical data taken from the ADS database (Marshall *et al*, 2002).

Summary: Boxgrove is an important site for understanding the manufacture and use of some of the earliest handaxes in Britain. Superior recording and analysis, combined with extensive publication (Roberts *et al*, 1996, 1997, 1999) make it an ideal choice for studying handaxes in the context of the surrounding landscape and environment. The use of the site in the raw material model of handaxe manufacture (White, 1998a) allows for analysis and critiquing of this model through the use of both first-hand observation and statistical analysis.

4.3.3 WARREN HILL, MILDENHALL, SUFFOLK (TL 744 743)

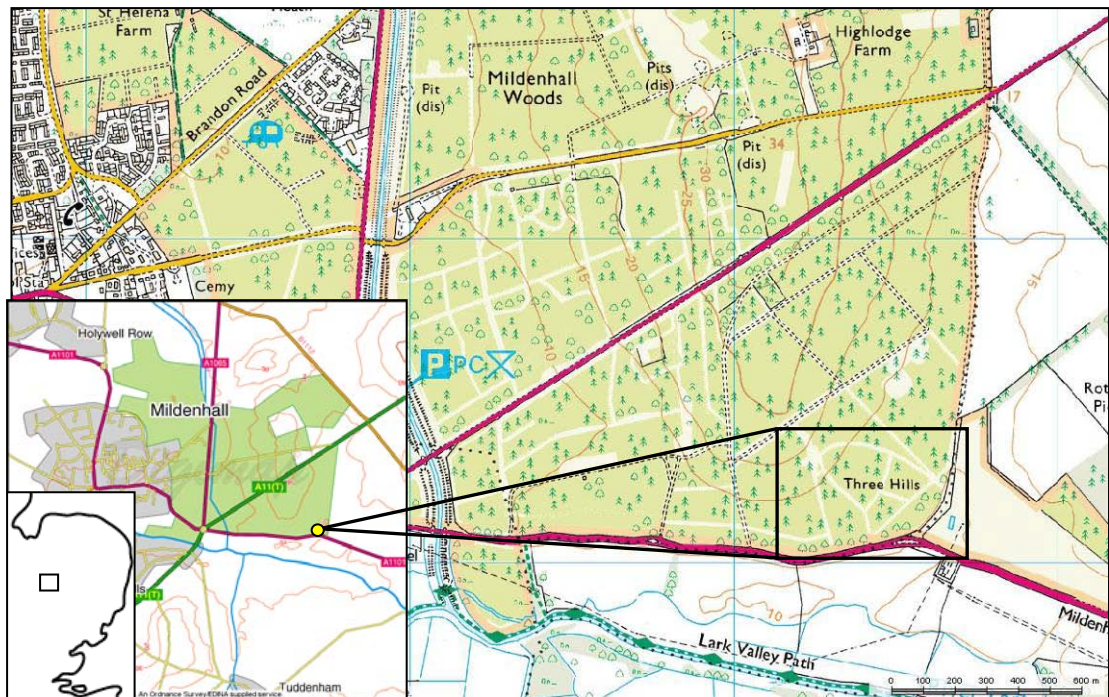


Figure 4. 8: Map of the present-day Warren Hill site (Insets – Mildenhall and surrounding area and East Anglia). © Crown Copyright/database right 2007. An Ordnance Survey/EDINA Digimap supplied service.

Introduction: Warren Hill is notable for being a prolific handaxe site, with an estimated 2000 handaxes recorded during gravel extraction (Wymer, 1999). It is situated in the Three Hills area of Mildenhall Forest, Suffolk, less than 1km south of another well known Palaeolithic site, High Lodge (see top of Figure 4.8). The handaxes were mostly collected between the end of the 19th and early 20th centuries but the total number is not known. Recent work by Lee *et al* (2004) has confirmed the pre-Anglian date of the deposits, placing Boxgrove and Warren Hill in the same chronological period thereby validating the visual similarity of the handaxe assemblage from the two sites (Wymer, 1999).

Geological and Stratigraphic Context: An assessment of the Warren Hill stratigraphy was undertaken in 1991 (Wymer *et al*, 1991) and identified two

sedimentary units. The artefacts originate from within the fluvial gravels (Unit 2), which contain a mixture of flint, chalk and quartzite (Wymer *et al*, 1991) and suggest deposition by a large river. The preferential use of flint for the handaxes suggests that a proliferation of good quality Norfolk flint was available for use by hominins so the use of quartzite was rare (Wymer, 1999).

Environment, Flora and Fauna: There is no verified environmental data at present available from Warren Hill (Wymer *et al*, 1991). The handaxes were deposited in the Bytham Sands and Gravels, the remnant of a now extinct river system that ran from Stratford-Upon-Avon, through Leicestershire then into Suffolk and Norfolk (see Figure 4.9). The Bytham River system was obliterated during the Anglian glaciation (Rose, in Ashton *et al*, 1992).



Figure 4. 9: The course of the Bytham River. ('Reproduced by permission of The Geologists' Association from PROCEEDINGS OF THE GEOLOGISTS' ASSOCIATION, R.M.Bateman & J.Rose, Fine Sand Mineralogy of the Early and Middle Pleistocene Bytham sands and gravels of midlands England and East Anglia, **105**, 33, fig. 1 © 1994 The Geologists' Association.)

Lithic Assemblage Potential and Rationale: The use of the Warren Hill dataset (Marshall *et al*, 2002) is advantageous for several reasons. Firstly, through its age and the predominance of ovate handaxes, Warren Hill provides a good corollary with which to compare the Boxgrove assemblage. It is also one of the sites included by

Roe (1968) in his study of Lower and Middle Palaeolithic handaxe assemblages (Group VII – Less Pointed Ovates). The dating of the site, whilst not precise, is firm enough to provide a pre-Anglian ELP date (480,000-510,000 BP), allowing the study of some of the earliest British handaxes. Solomon (1933) and Roe (1968) noted the presence of two distinctive groups of handaxes within the assemblage, one fresh and one worn. Roe noted the presence of twisted and tranchet finished handaxes only in the fresh assemblage, which is posited to be more recent than the worn assemblage. It would be informative to examine the differences between the two types and attempt to ascertain the basis for this.



Figure 4. 10: Photograph of Warren Hill implement (from Marshall database).

Data Collection: The ADS database (Marshall *et al*, 2002) forms the metrical dataset for this site. It contains the measurements for 341 Warren Hill flint handaxes from the Sturge Collection at the British Museum Stores. For this study I have selected the Fresh and Lightly abraded subset of 148 handaxes.

Summary: Warren Hill's stratigraphic provenance as a pre-Anglian glaciation deposition and the large number of handaxes from one site deserves further attention, not least because they provide a good corollary for Boxgrove handaxes in terms of form and date. The lack of environmental data does not preclude study. There are also interesting patterns in manufacture that have been flagged by previous researchers (Solomon, 1933; Wymer, 1991; Roe, 1968) and warrant closer examination.

4.3.4 MARINE ISOTOPE STAGE 12 – THE ANGLIAN GLACIATION

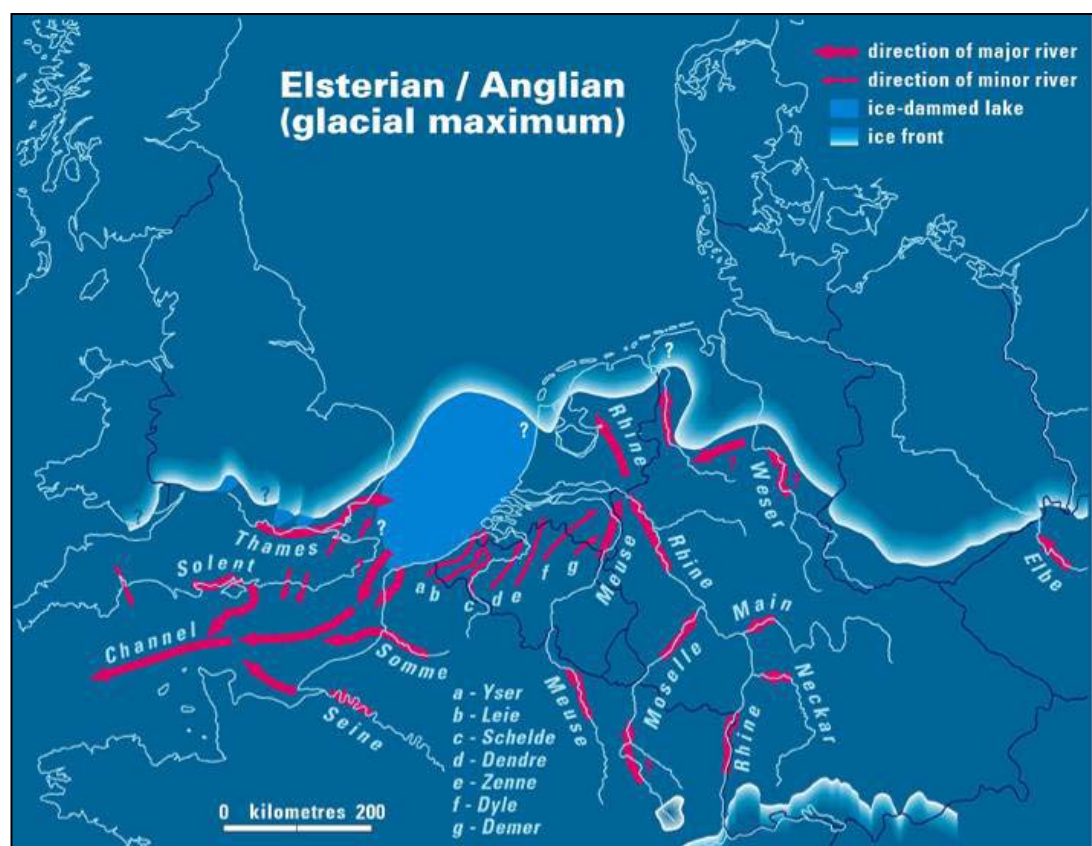


Figure 4. 11 – Map showing the extent of the Anglian Ice Sheet and the extant river system. Taken from: <http://www-qpg.geog.cam.ac.uk/research/projects/nweurorivers/>

The Anglian glaciation represents the severest glacial maxima during the period studied. As illustrated above (Figure 4.11), the majority of the British Isles was covered by ice. Habitation in this period is not evident. The Weald-Artois land bridge

(White and Schreve, 2000) that existed before the Anglian Glaciation (MIS 12) connected South-Eastern Britain across what is now the Dover Strait to France. This land bridge acted as a barrier to an ice-dammed glacial lake in the North Sea. Sedimentary records indicate that there was episodic flooding into the basin at high sea levels, but that the land bridge remained open at all times, providing a permanent link to the mainland. During periods of low sea level, this basin would have been habitable, and study of the channel base indicates that there was a developed system of major rivers (Gupta *et al*, 2007). At the time of the Anglian glaciation, the land bridge was breached by the overspill of the Elsterian/Anglian glacial lake, severing the permanent connection to mainland Europe, with a return to peninsular status during low sea level events. From the Anglian period onwards, the nature of the British Isles changed. It is suggested that complete isolation from the mainland was rare (Sutcliffe, 1995). White and Schreve (2000) suggest there were probably episodes of isolation during high sea levels, which occurred at the interglacial maxima (Keen, 1995). This has implications for the nature of the colonisation of Britain from MIS 11 onwards. The colonisation of the northern-most areas of Europe would have been possible in glacial periods but would have been unlikely, as the extreme conditions would have been inhospitable to humans, animals and plants alike. Yet, after the breach, temperate conditions would have led to high sea levels that would also have made colonisation of Britain more difficult (White and Schreve, 2000).

4.3.5 MARINE ISOTOPE STAGE 11 – THE HOXNIAN INTERGLACIAL

The Hoxnian Interglacial Stage (MIS 11) was identified by West (1956) from the type-site sediments at Hoxne, although the archaeological remains at Hoxne are now dated to after the main Hoxnian interglacial sequence (Stringer, 2006). It is correlated with the Holsteinian Stage in North-West Europe (Gibbard and Kolfschoten, 2004). As with the Cromerian, it is indicative of a temperate climatic stage and signifies the re-incursion of hominin populations into Britain after the Anglian glaciation. A particularly rich pollen record at Marks Tey has enabled the division of the Hoxnian into four distinct pollen substages (Ho I – Ho IV) based on the succession of various vegetation types (Jones and Keen, 1993) relating to different climatic events between 423,000- 380,000 BP (Wymer, 1999). Sea level is estimated to be higher than that of the present day, although accurate estimates are problematic due to land uplift. Pollen types indicate a predominance of forested areas across large areas of the British Isles at this time (Jones and Keen, 1993) although this was not constant throughout MIS 11 (Ashton *et al*, 2006). Sites from this period are often extremely well preserved due to deposition within depressions caused by the preceding Anglian glaciation (Ashton *et al*, 2006). Mammalian fauna indicates a predominance of large mammals including elephant, bear, giant deer, lion and rhinoceros, alongside roe deer, beaver and lemming. Some of these species indicate it was slightly warmer and drier than the contemporary British climate (Jones and Keen, 1993). Research by Ashton *et al* (2006) indicates that the environment had a large impact on the location of sites in the Hoxnian, related to the density of woodland and relative accessibility of resources. This research has also shown a preference for sites alongside riverine environments where resources were more readily available and navigation was easier (Ashton *et al*, 2006).

4.3.6 HITCHIN, LETCHWORTH, HERTFORDSHIRE (TL 181 291)

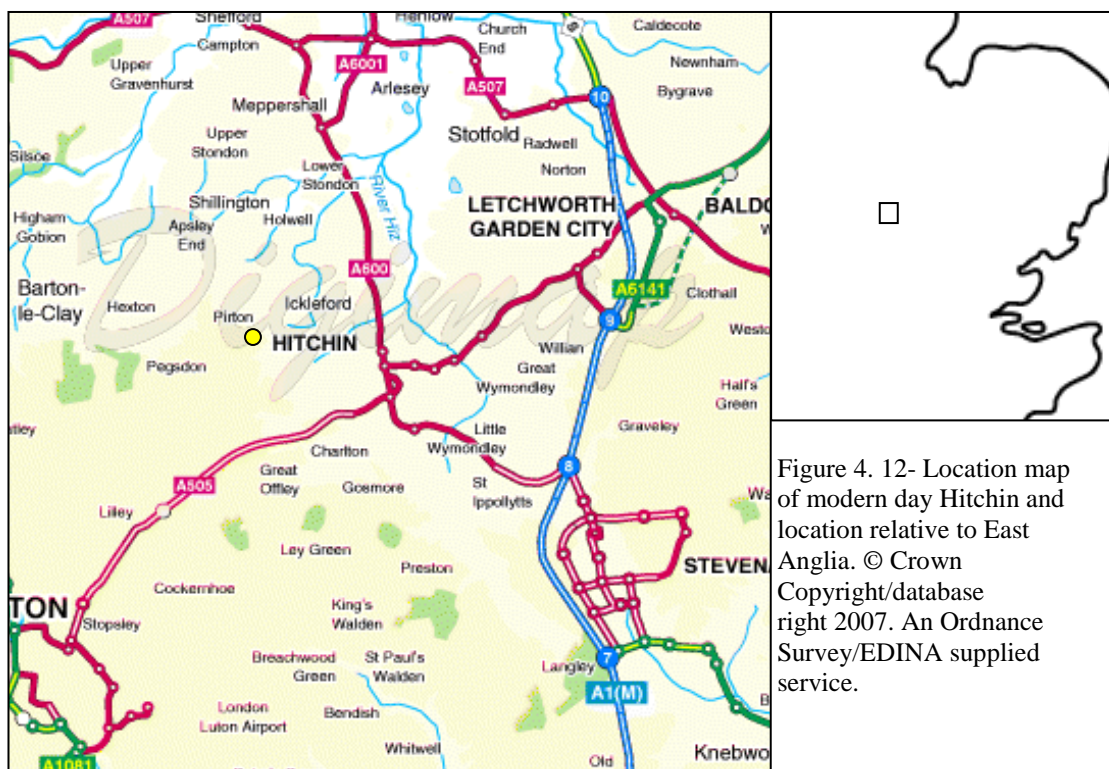


Figure 4. 12- Location map of modern day Hitchin and location relative to East Anglia. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: In the vicinity of the modern-day town of Hitchin a collection of 60+ handaxes have been amassed from 19th and 20th century brick pits. Kettle-holes, remnants of the Anglian glaciation, provided the foundation for small lakes into which palaeoliths were deposited in the Hoxnian period (Wymer, 1999; Ashton *et al*, 2006). Correlation with the sequence at Hoxne was first suggested by Reid (1897) and confirmed by Boreham and Gibbard (1995).

Geological and Stratigraphic Context: Investigations into the stratigraphic sequence in the Hitchin area in the 19th Century (Reid, 1897) revealed a gravel layer containing handaxes overlying lacustrine sediments. Boreham and Gibbard's (1995) investigation revealed an incomplete section of Hoxnian-age deposits, with interglacial lake deposits bedded over gravel and underlying brickearth deposits.

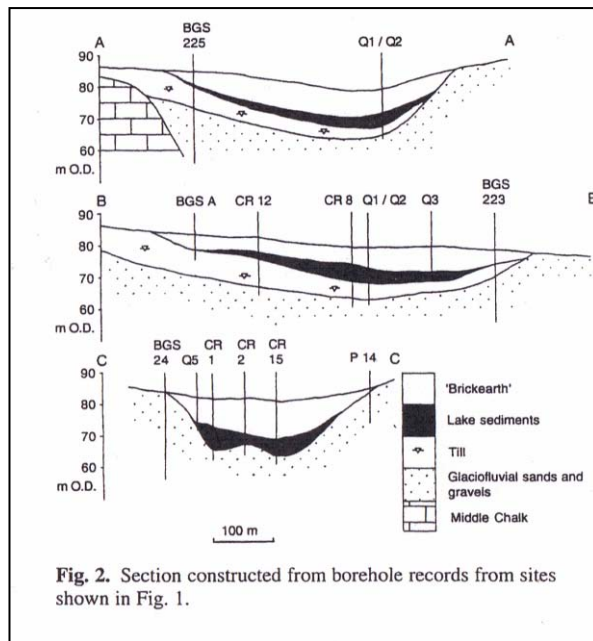


Figure 4. 13- Reconstructed section of the deposits at Hitchin (Taken from Boreham and Gibbard, 1995, 262).

Environment, Flora and Fauna: Pollen analysis was undertaken in order to assign the deposits at Hitchin to a particular biozone in the Hoxnian sequence (Boreham and Gibbard, 1995). As the handaxes are only attributable to a layer at the base of the brickearth (Reid, 1897; Ashton *et al*, 2006), it is difficult to assign a particular biozone to the Hitchin handaxes, although it is suggested that their deposition took place in the stage Ho IIc (Boreham and Gibbard, 1995). The area around the body of water was treeless, with pollen indicating temperate deciduous woodland in the vicinity. Remains of large mammals (bear, straight-tusked elephant, rhinoceros), fish, molluscs and plants (mixture of aquatic and grassland species) are also preserved, indicating a rich, temperate environment. The deposits sampled by Boreham and Gibbard (1995) were assigned to the Ho I and Ho II pollen zones.

The authors hypothesise that the kettle hole formed into a lake and gradually infilled with lake sediments during the early stages of the Hoxnian. The lake became shallower as it infilled and became a pond complex. The brickearth was deposited in following cold stage (Boreham and Gibbard, 1995).

Lithic Assemblage Potential and Rationale: The Hitchin handaxes, although not well excavated or provenanced, are worthy of inclusion into the dataset for several reasons. Firstly, the presence of well worked ovate handaxes, some with twisted edges affords a glimpse into the changing manufacturing methods of MIS 11. The

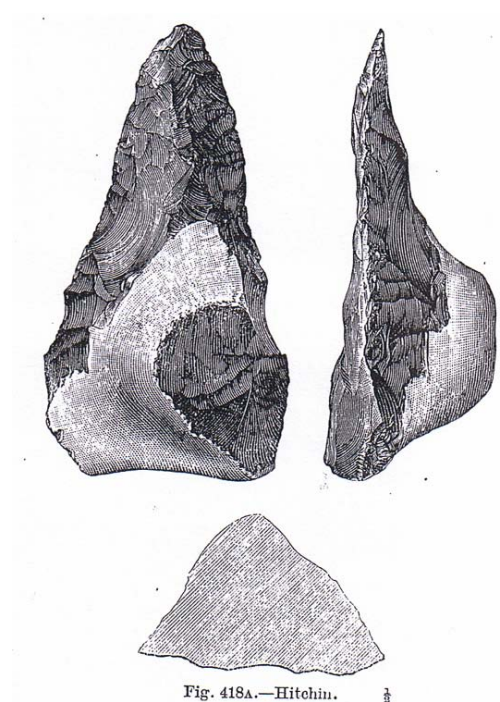


Figure 4. 14- Hitchin handaxe. From Evans (1872) pg 537.

presence of a distinct twisted handaxe ‘complex’ has been noted by White (1998a) and may reflect a cultural signature in handaxe manufacture (Wenban-Smith, 2004). Roe (1968) studied Hitchin, classing it as Group II – pointed with ovates. In terms of age and stratigraphy, the site is a good comparator for Swanscombe (see below).

Data Collection: The dataset for Hitchin consists of 25 flint handaxes measured by hand, from the W.Ransom, Sir H.Read, Sturge, W.G.Smith, Trechmann, Wellcome and J.N.Ford Collections at the British Museum (Franks House). These were selected at random.

Summary: The handaxes from Hitchin, whilst not securely provenanced, can be placed within the Hoxnian period (MIS 11). They provide an opportunity to examine the next wave of human incursion into Britain subsequent to the Anglian glaciation (MIS 12). The potential for elucidating key differences in the methods of manufacture between the Cromerian and the Hoxnian may lie in the presence of twisted ovate handaxes from this and other sites in MIS 11.

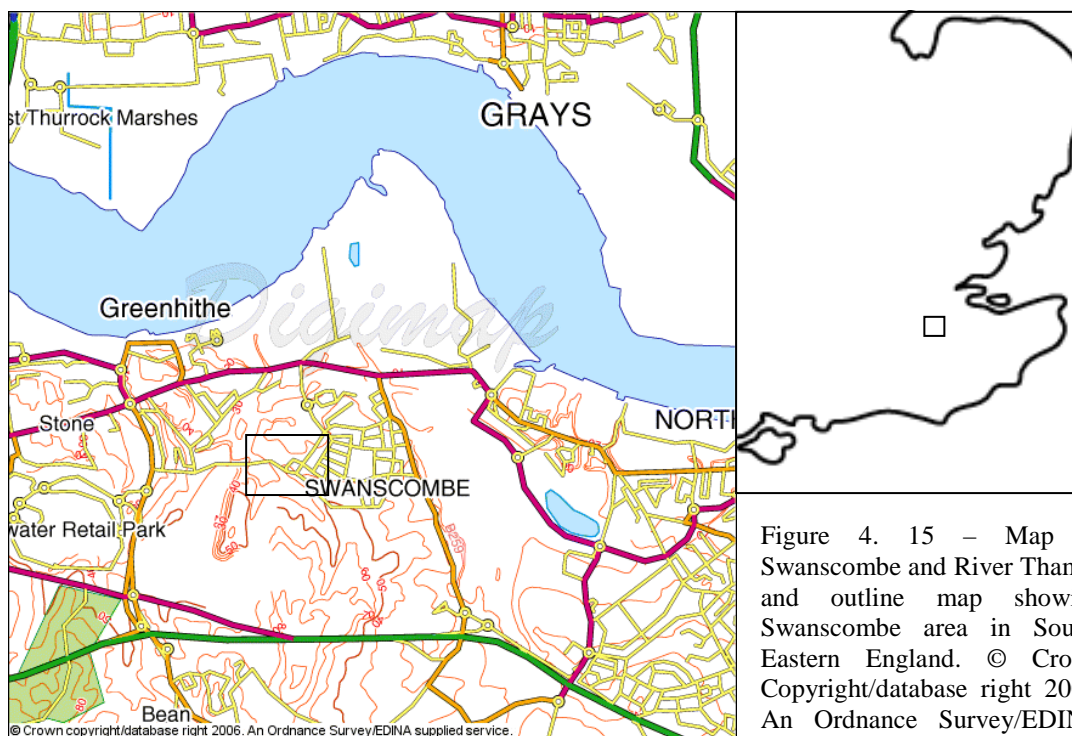


Figure 4. 15 – Map of Swanscombe and River Thames and outline map showing Swanscombe area in South-Eastern England. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: The site of Swanscombe, Kent, shares a similar history to many British Palaeolithic sites. It was first discovered during the process of gravel extraction in the late 19th Century and was extensively studied throughout the 20th Century. The site has been excavated on several occasions: in 1912 (Smith and Dewey, 1914), 1955-60 (Wymer, 1964), 1968-72 (Conway *et al*, 1996) and more recently a re-evaluation of the stratigraphy took place (Bridgland, 1994). Swanscombe is situated in the southern reaches of the Thames Basin, 5km east of Dartford. The site is famous for the discovery of the Swanscombe skull, attributed tentatively to *Homo heidelbergensis*, that dates to approximately 400,000 BP and is contemporary with the Acheulean flint assemblage (Stringer and Hublin, 1999; Conway *et al*, 1996).

Swanscombe has a large collection of faunal remains which are now thought to have derived from natural accumulation (Smith, *pers. comm.*) but may be of use when attempting to reconstruct the environment in which handaxes were manufactured.

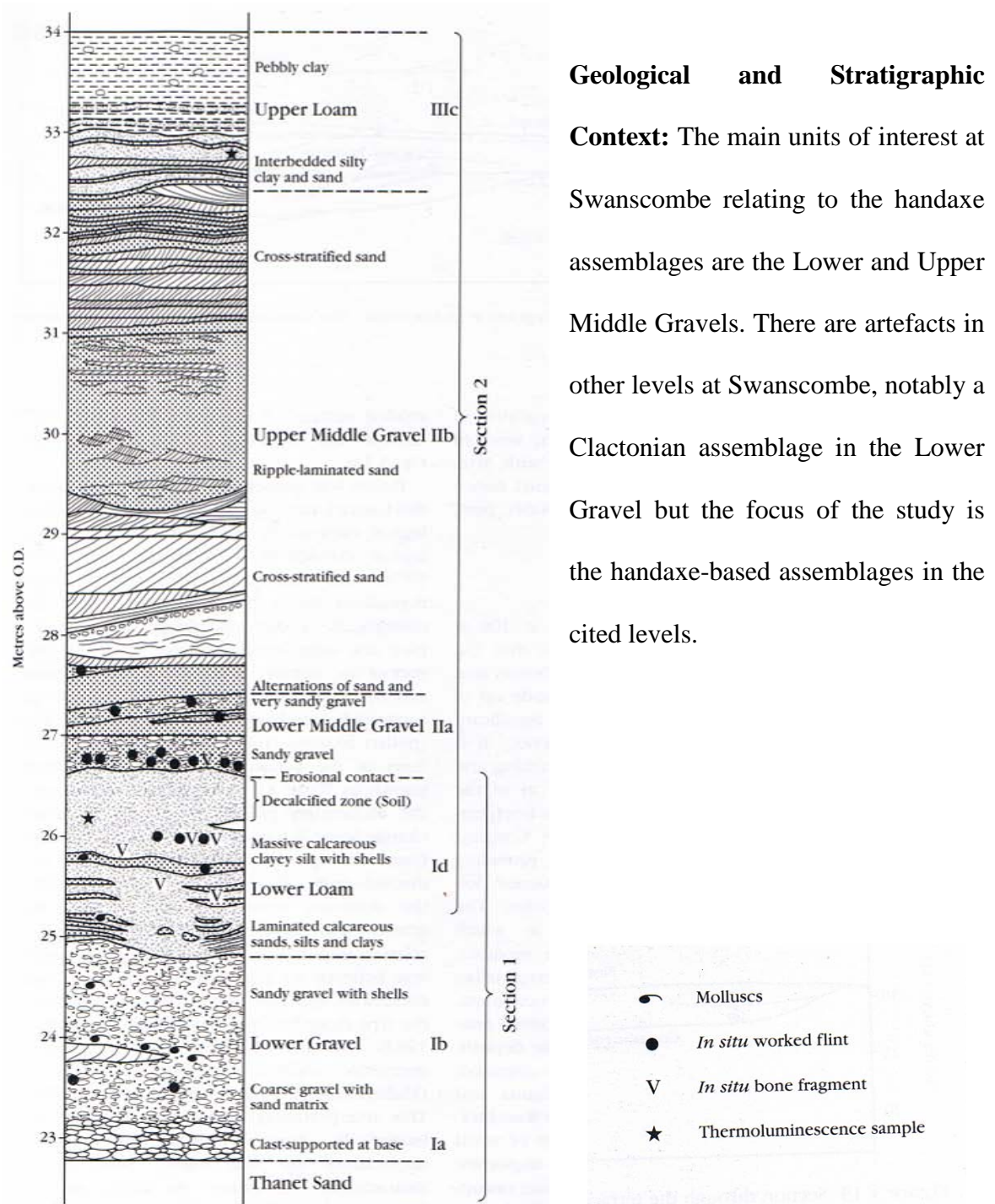


Figure 4. 16 – Stratigraphic sequence at Swanscombe (taken from Bridgland, 1994, 199).

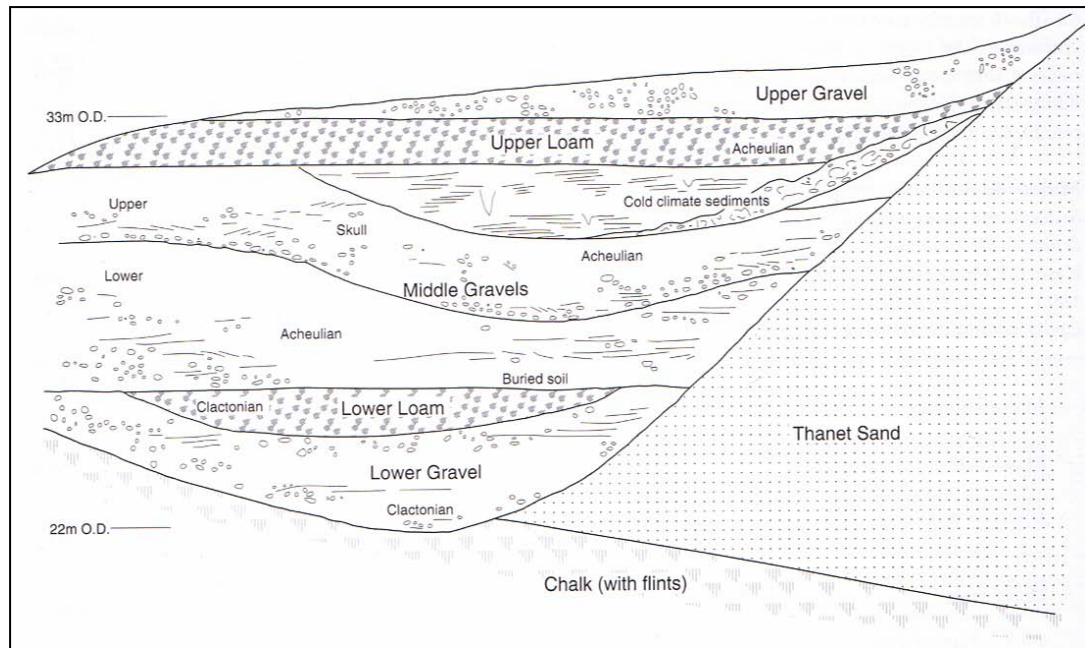


Figure 4. 17 – Illustration of the juxtaposed levels at Swanscombe and associated industries. Taken from Wymer, 1999, 74.

The stratigraphy at Swanscombe consists primarily of fluvial sediments that were deposited in several phases (Bridgland, 1994). The site is situated above the Boyn Hill Terrace, part of the sequence of terraces created by the Thames throughout the late Middle and Upper Pleistocene (see Figure 4.18). On the basis of the terrace arrangements, the Basal Gravel, containing a derived Clactonian assemblage, was laid down in late MIS 12. The overlying Lower Gravel and Lower Loam were deposited in warm conditions (early MIS 11), with an in situ Clactonian assemblage emplaced in the Lower Loam. These three sedimentary contexts form Phase I of the deposition at Swanscombe. In-between Phase I and Phase II a cooler period produced a hiatus of deposition. The Lower Middle Gravels were then deposited in the middle of MIS 11 in a warm phase. The associated Acheulian industry is derived. Phase II is completed by the deposition of the Upper Middle Gravels towards the end of the Hoxnian Interglacial and contains a locally derived Acheulian industry. Both deposits were laid down in warm conditions. Phase III consists of the Upper Sand, Loam and Gravel, the age of which has not yet been determined. (Wymer, 1999).

The warm MIS 9 deposit also contains an Acheulian assemblage that is typologically distinct from assemblages below it (Roe, 1968; Bridgland, 1994).

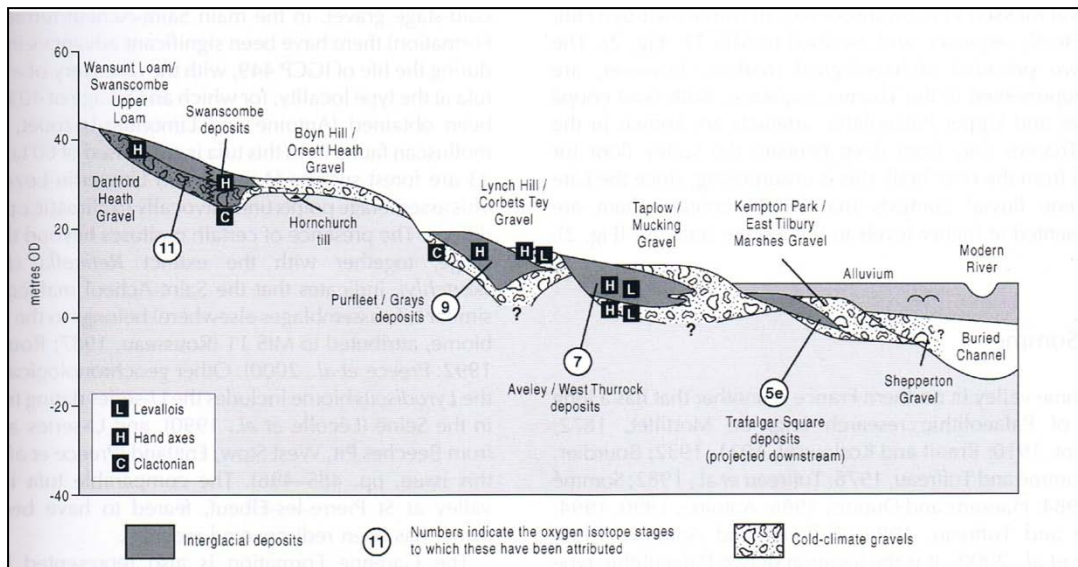


Figure 4.18– Revised Thames terrace sequence showing Swanscombe deposits (Bridgland 2006, 439).

Investigations by Bridgland (1994) of the sequence of terraces in the Thames Valley, provided a useful scheme against which to date the Swanscombe site. Prior to this, there had been some debate as to the chronological sequence at Swanscombe (c.f. Szabo and Collins, 1975; Gibbard, 1994). The molluscan samples (Conway *et al*, 1996) and the biostratigraphic corollary (Schreve, 1997) suggested a Hoxnian age, and the assertion by Bridgland (1994) that the site at Swanscombe was occupied immediately following the diversion of the Thames in MIS 12 provided a substantial body of supporting evidence for a Hoxnian age.

Recent work attempting to recalibrate the Vostock ice core (Petit *et al*, 1999) allows for a much more precise date of 410 ka to 390 ka to be attached to the period of climatic peaking then marked deterioration. Morphological evidence of climatic change at Swanscombe places the skull fragment between the two, at c.400,000 BP,

making it one of the oldest specimens of skeletal remains to show clear Neanderthal affinities (Stringer and Hublin, 1999).

Environment, Flora and Fauna: There is an extensive faunal record preserved at Swanscombe although it cannot be directly attributed to hominin action (Smith, *pers. comm.*). Swanscombe is the type-site for the mammalian biostratigraphic suite of this period (Wymer, 1999). The fauna contains a number of rare taxa and includes rhino, fallow deer and horse, although hippopotamus and hyena are absent (Bridgland, 1994). Schreve (in Conway *et al*, 1996) cautions against the drawing of parallels between the environmental tolerances of extinct species and their extant corollaries, but uses fallow deer, beaver and water vole as examples of species with relative continuity to examine the environment at Swanscombe. Fallow deer indicate a temperate woodland environment, whilst beaver indicates that the woodland was deciduous and also the presence of a slow-flowing water body nearby. Water-vole confirms the presence of water (Schreve, in Conway *et al*, 1996).

Lithic Assemblage Potential and Rationale: The position of Swanscombe as a key type-site for the Hoxnian period makes it a definite inclusion in any study of handaxe-based Acheulian assemblages. There is an adequate faunal and floral record, making it possible to compare the handaxes in an environmental context. Raw material types at Swanscombe were studied by White (1995) and the assemblage is assigned to Group II (Pointed with Ovates) by Roe (1968). Swanscombe affords the ability to study handaxe manufacture in the Hoxnian under conditions where raw material is not as good quality as the sites previously discussed (White, 1995). The co-occurrence of lithics and hominin remains, as at Boxgrove, allows for some speculation into the nature of early hominin thought-processes, relating to

manufacture of handaxes on poor quality river gravels, as distinct from that of Boxgrove's *H.heidelbergensis*.



Figure 4. 19 - Swanscombe handaxe. Photo: KE.

Data Collection: The 30 flint handaxes that were studied came from the Wymer Collection at the British Museum (Franks House), excavated between 1955 and 1960 (Wymer, 1964). They were recovered from the Upper Middle Gravels.

Summary: Swanscombe is a key site for the Hoxnian Interglacial (MIS 11) and, as such, could not be excluded from the study of bifacial form and manufacture. The site is well excavated and recorded, with a large body of faunal data. The lithic assemblage is believed to be locally derived (Wymer, 1999), made on poorer quality river gravels and is one of the most pointed industries in the British Isles (Roe, 1968). This provides a good contrast to the ovate-dominated, fresh flint, in situ assemblage from Boxgrove. The use of the site in two key models of handaxe manufacture (Roe, 1968; White, 1995) allows for analysis and critiquing of these models through the use of both first-hand observation and statistical analysis.

The Late Lower Palaeolithic (LLP) covers the timescale from 380,000 to 290,000 BP (MIS 10-9). The whole period from MIS 10 to MIS 6 is known as the Wolstonian Complex (Wymer, 1999) and equates to the Saalian period in North-West Europe (Gibbard and Kolfshoten, 2004). For the purposes of this study, the Wolstonian has been split to recognise the difference in the dominant mode of tool manufacturing technique between the earlier and later stages of the Wolstonian. Handaxe manufacture continues to be dominant in MIS 10-9, whereas Levallois technique appears and becomes more dominant in MIS 8-7.

4.4.1 MIS 10 – UNNAMED GLACIAL STAGE

This glacial period from 380-320,000 BP correlates to the Thames Valley deposits at Boyn Hill and basal Lynch Hill/ Orsett Heath deposits (Figure 4.20). The ice sheet is not thought to have advanced as far as it did during the Anglian glaciation (Wymer, 1999) but there are few corresponding sediments to attribute to this period. The MIS curve shows a significant drop in temperature during MIS 10. Lack of information about this glacial stage is partly due to uncertainty over the exact chronology and nature of deposition between MIS 12 and MIS 9, with some authors originally attributing the glacial deposits at Wolston to a second depositional phase in the Anglian (MIS 12) (c.f. Bridgland, 1994) or to a more recent glaciation in MIS 6-8 (Wymer, 1999). Work at Purfleet, Essex (Schreve *et al*, 2002) has uncovered a good sequence of sediments that show distinct glacial and interglacial sequences distinguishing MIS 10, 9 and 8. Although there is no palaeoenvironmental evidence for MIS 10 it can be characterised as a distinct cold stage. This is supplemented by re-evaluation of a sedimentary sequence at Frog Hall Pit, near Coventry indicating

that there are cold stage and interglacial deposits that are neither MIS 12 or MIS 8 (Keen *et al*, 1999)

4.4.2 MIS 9 – THE PURFLEET INTERGLACIAL

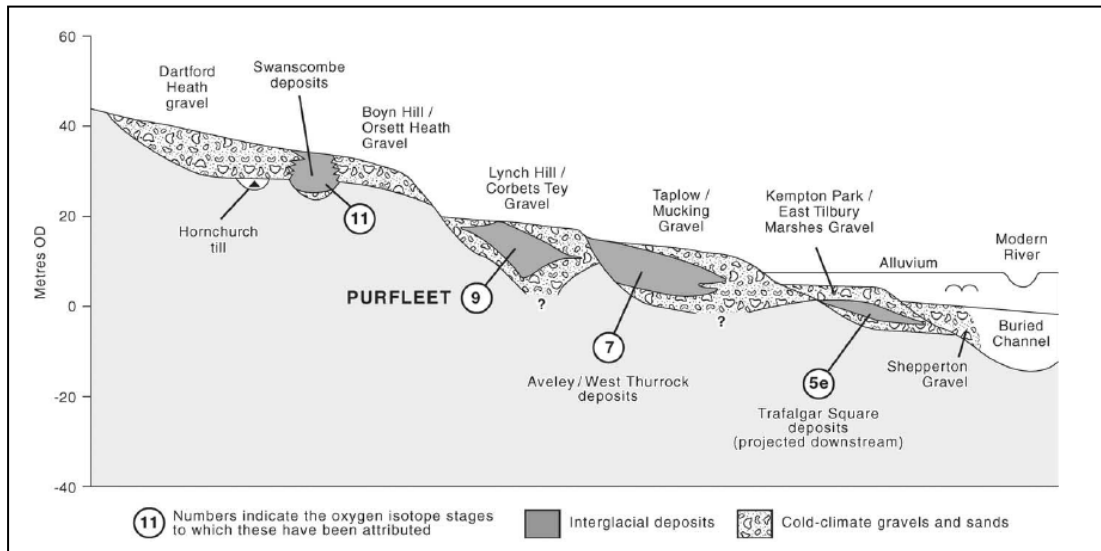


Figure 4. 20 - Terrace sequence in the Lower Thames, highlighting Purfleet and MIS 9. From Schreve *et al* (2002, 1426).

Key information about this interglacial has only been recently synthesised (Schreve *et al*, 2002). Prior to this, an MIS 9 interglacial was posited, but had neither been named or qualified. Excavations at Purfleet, on the Thames in Essex, provided a long sequence of deposits throughout the Wolstonian, representing different stages of deposition of the Corbets Tey Formation. This data came from a long history of several excavations and 4 disused chalk quarries in Purfleet. An expanded version of the following can be found in Schreve *et al* (2002).

Summary table of the Purfleet sequence with suggested oxygen isotope (OIS) correlations							
Bed	Lithostratigraphy	Lithology	Biological evidence	Palaeoenvironment	Climate	Archaeology	OIS
8	Botany Gravel	Cross-bedded sands and horizontally bedded sandy gravel.	Vertebrates (rare)	Open ground?	cold ?	Levallois	8
7	Grey-brown silty clay	Mainly structureless grey-brown silty clay with occasional gravel. Weathered and decalcified.			Warm ?		9/8 ?
6	Bluelands Gravel	Horizontally and cross-bedded sand, grading into horizontally bedded sandy flint gravel.	Vertebrates (rare)	Open ground?	cooler ?	Acheulean	9/8 ?
5	Greenlands Shell Bed	Horizontally bedded sand with abundant molluscs and other fossils. Decalcified in places.	Vertebrates (common) Molluscs (very common) Ostracods	Temperate climate Mixed woodland, grassland and marshes Upper tidal reaches of a large slow-flowing river	warm	Rare flakes Possible butchered bone	9
4	Silty Clay	Silty clay laminae with partings of fine sand and silt; shell band present within this bed.	Vertebrates (rare, shelly band only) Molluscs (rare, shelly band only) Ostracods Pollen	Temperate climate Mixed oak woodland and open areas Adjacent marshes and standing water Upper tidal reaches of a large, slow-flowing river	warm		9
3	Shelly gravel	Gravels and sands, fining upwards, some cross-bedding. Calcareous nodules and fossils present.	Vertebrates (rare) Molluscs (common)	Temperate climate Large, slow-flowing river with adjacent marshes, woods and grassland	warm	Clactonian	9
2	Little Thurrock Gravel	Thin gravel. Chalk present but no fossils.			cold ?		10
1	Angular chalk rubble 'coombe rock'	Soliflucted angular to sub-rounded chalk clasts in chalk matrix.			cold	Rare flakes	10

Table 4. 3 - A summary of the climatic indicators from Purfleet (From Schreve *et al*, 2002, 1456).

The table above gives a summary of the key environmental indicators and an estimate of MIS dates for each deposit in the Purfleet sequence. Archaeological remains in the form of flint tools are present in isolation throughout the sequence and represent Clactonian, Acheulian and Levallois technological suites. A large river was responsible for the deposition of the body of sediments, which opened into a semi-marine embayment in close proximity to the site. Climatic indicators show the bulk of the sediments were deposited in a largely temperate environment with woodland, grassland and marshland in the vicinity. This deposit is book-ended by two cold stages. Schreve *et al* (2002) correlate these to MIS 8 and 10, with the temperate deposits representing MIS 9.

4.4.3 FURZE PLATT, MAIDENHEAD, BUCKINGHAMSHIRE (SU 878 831)

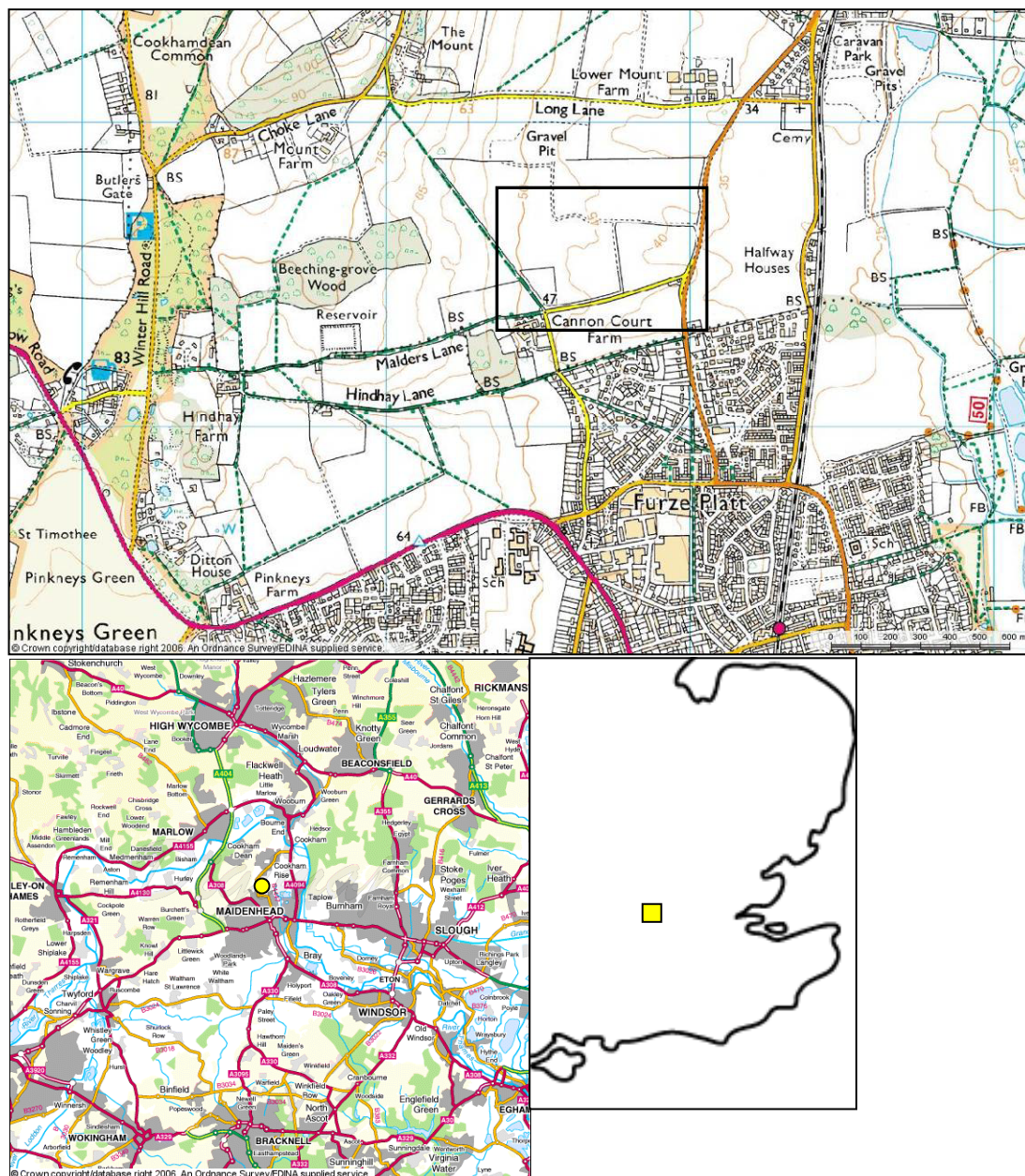


Figure 4. 21 - Map of Cannoncourt Farm, Furze Platt, and Maidenhead and surrounding area and outline map showing Maidenhead area in South-Eastern England. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: The site of Cannoncourt Farm Pit, Furze Platt, is situated approximately 1.5 miles from the right bank of the River Thames (Lacaille, 1940) and is well-known chiefly for the giant handaxe that was discovered there (Bridgland, 1994). At 31cm in length it is the single largest handaxe ever found in the United Kingdom (Wymer, 1999). Alongside this, a prolific handaxe assemblage

of over 600 handaxes were collected and excavated here in the late 19th to mid 20th century (Treacher, 1896; Lacaille, 1940).

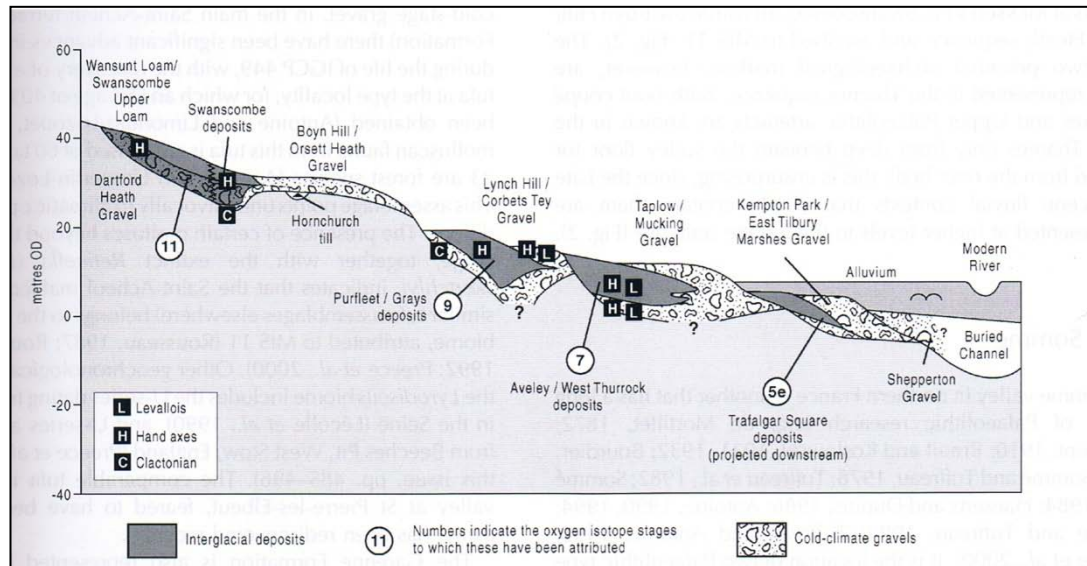


Figure 4.22 – Revised Thames terrace sequence showing Lynch Hill Gravel (Bridgland *et al*, 2006, 439).

Geological and Stratigraphic Context: Lacaille (1940) described the artefacts as coming from the base of a poorly stratified fluvial gravel containing nodules of flint and erratics which was confirmed by Wymer (1968). The gravel identified by Bridgland as the Lynch Hill Gravel (Bridgland, 1994) is overlain by a silty-clay complex upon which a palaeosol had formed, indicating that there was at least one warm phase subsequent to the deposition of the gravel. Roe (1964) placed the Furze Platt handaxes in his Middle Acheulian grouping, linking them with Baker's Farm, Stoke Newington and Cuxton, attributing them to a Hoxnian age (Roe, 1968). This is disputed by the stratigraphic position of the Furze Platt assemblage, with a Lynch Hill Gravel position indicating an MIS 9 (Purfleet Interglacial) derivation.

Environment, Flora and Fauna: There is limited faunal evidence that cannot be attributed to any biostratigraphic grouping (Lacaille, 1940).

Lithic Assemblage Potential and Rationale: Lacaille (1940) noted that there was a *‘prevalence of exceptionally large and massive tools’* (256) and also that there were a large number of flake-based bifacial implements amongst the assemblage. White (1998a) studied the Furze Platt handaxes and proposed that the source of the raw material for the Furze Platt handaxes was the coarse Thames gravel found in the river bed as the fresh chalk currently exposed within the area would not have been available to hominins (although see Wenban-Smith, 2000 for an alternate view). Wymer (1968) recorded 589 Furze Platt handaxes from the Reading and Oxford Museums (somewhat less than the 1663 recorded by Roe (1981) nationwide), noting a preponderance of pointed Type E and F handaxes, very few ovates and a small collection of cleavers. Just under half of the implements were in sharp or mint condition. Furze Platt was selected to form part of the current study as it formed both a part of White’s (1998a) and was also used by Wenban-Smith (2000) as a means to refute White’s conclusions. Roe (1968) placed Furze Platt within Group I (Pointed with Cleavers). The site also forms part of the review of the Quaternary of the Thames (Bridgland, 1994), making it relatively well documented.

Figure 4. 23 - The 31cm ‘giant’ handaxe donated to the Natural History Museum (photo from NHM website).



Data Collection: The 25 flint handaxes recorded from Furze Platt formed part of the Lacaille Collection at the British Museum Stores (Franks House) and were selected at random.

Summary: The site at Cannoncourt Farm, Furze Platt, is an important and well-studied assemblage despite not having an environmental context. The use of Furze Platt as a case-study by Roe (1968) and White (1998a) provides an opportunity to study their observations and conclusions, as well as the counter claims by Wenban-Smith (2000). It will also be informative to look at the validity of grouping of Furze Platt with Cuxton by Roe (1968) as the relative age of the former site has changed since his study.

4.4.4 WOLVERCOTE, OXFORD, OXFORDSHIRE (SP 498 105)

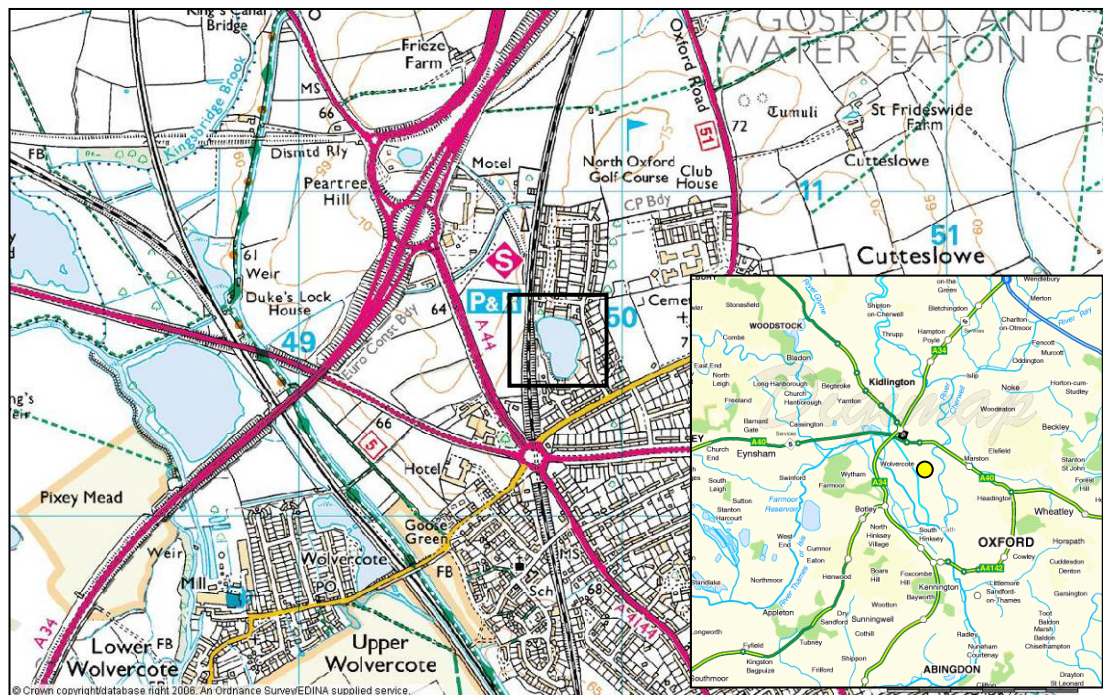


Figure 4. 24 - Map of the site of Wolvercote Brick Pit, now an ornamental lake. Inset: Wolvercote and surrounding area. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: Wolvercote is situated to the north-west of Oxford, and is known primarily for its well-made plano-convex handaxes. Another discovery from the turn of the 20th Century, the artefacts were collected from an Oxford brick-pit by Bell (1894). The age of the site is still contentious, but consensus opinion places it within the region of MIS 9 (Ashton, 2001). Wolvercote is argued to be a primary context assemblage and is dominated by handaxes, though this is likely to be a result of collection bias (Tyldesley, 1986). The site suffers from a lack of good quality raw material and this is seen as a key influence on the form and methods of manufacture.

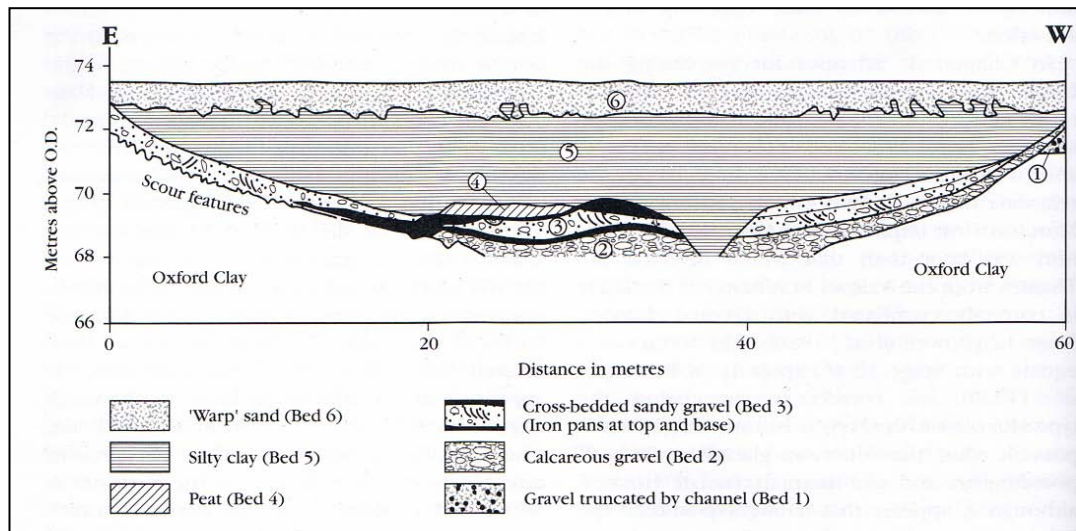


Figure 4. 25 - The Wolvercote Channel and associated deposits. From Bridgland (1994, 58).

Geological and Stratigraphic Context: The handaxes and associated finds from Wolvercote were deposited in a large channel and beach deposit overlain by sand (Sandford, 1924). The channel cuts through the Wolvercote Terrace gravel and into Oxford Clay. Full exposures of the sequence have not been seen since for many years and much of the stratigraphy is taken from the earlier investigations of Bell (1894) and Sandford (1924). The artefacts are mostly found in Bed 2 of the deposits, others from ferruginous gravel above (Bed 3). The staining on some of the artefacts indicates they were deposited near one of the iron pans at the base and cap of the Bed 3 deposits (Figure 3.29). Interpretation of the position of the Wolvercote Channel and its associated Wolvercote Gravel deposits has been controversial since the site's discovery. Age estimates range from the Hoxnian (MIS 11; Arkell, 1947; Bishop, 1958; Wymer, 1968) to the Ipswichian Interglacial (MIS 5e; Sandford, 1932; Dines, 1946; Roe, 1981). The terraces in the Upper Thames have been correlated by Bridgland (1994) with those from the Middle and Lower Thames (Figure 3.30). The deposits from the Summertown-Radley Terrace correspond to two interglacial deposits – MIS 5 and MIS 7. The stratigraphic position of the Wolvercote Gravels on a higher terrace than Summertown-Radley indicates they are of greater antiquity. By

process of elimination, the Hanborough gravel deposits, a further step up the terrace, are dated to MIS 10 and, as such, can only leave MIS 9 for the formation of the Wolvercote Channel and MIS 8 for its cold climate infilling. This correlates the Wolvercote Channel deposits with the Lynch Hill and Corbets Tey gravels from the Middle and Lower Thames (Bridgland, 1994).

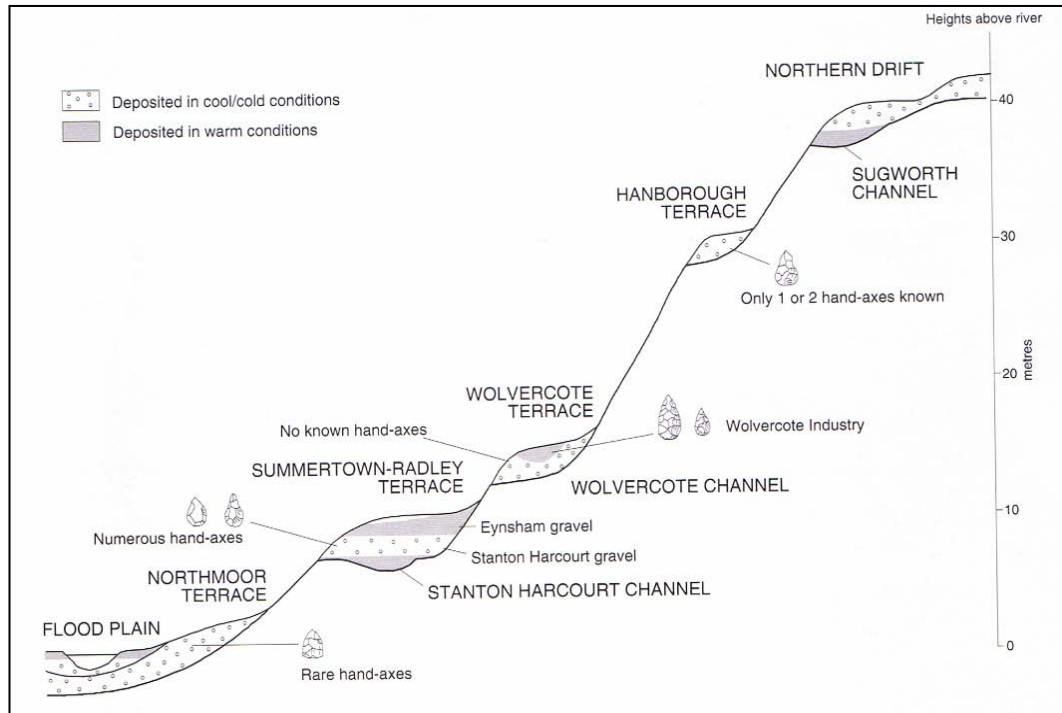


Figure 4. 26- The Upper Thames terrace sequence and associated archaeology (Wymer, 1999, 56).

Environment, Flora and Fauna: The fauna found at Wolvercote includes elephant, rhino, aurochs, deer and horse, possibly supplemented by bison, reindeer and bear which Tyldesley (1986) interpreted as indicating a warm, temperate environment. None of the molluscan fauna identified yielded clues to a specific climatic regime but plant macrofossils from higher up in the sequence indicated that the channel was infilled in a period of climatic cooling (Bridgland, 1994).

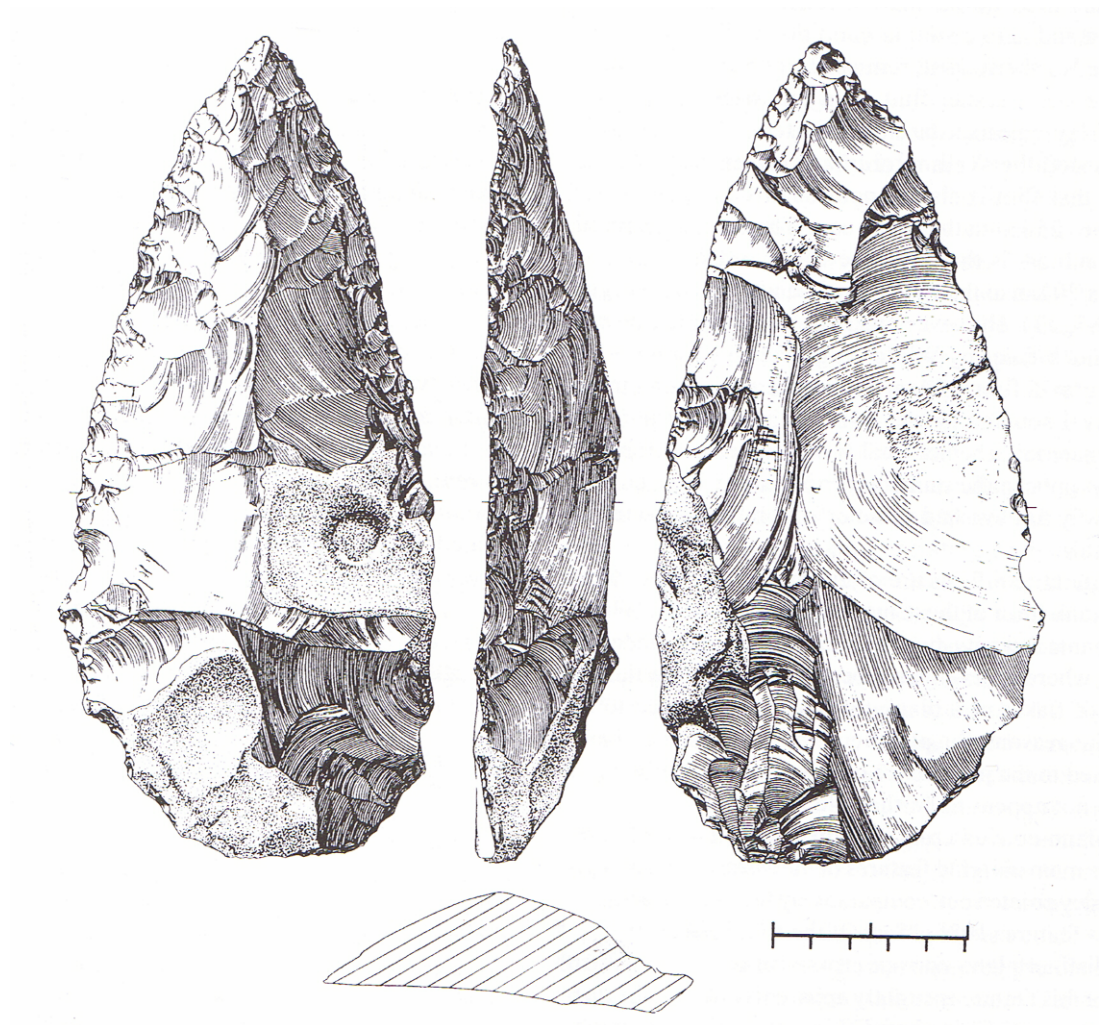


Figure 4. 27- A typical, 'slipper-shaped' handaxe from Wolvercote (taken from Ashton, 2001, 202)

Lithic Assemblage Potential and Rationale: The major importance of the Wolvercote assemblage is the plano-convex, slipper-shaped handaxes (Figure 4.27), noted by Roe (1981) and Wymer (1968) as a feature characterising, if not peculiar to, this assemblage. Tyldesley (1986) felt the influence of plano-convexity at Wolvercote had been exaggerated but emphasised the presence of a subgroup of large, well-worked plano-convex handaxes which could be defined as different from other handaxe types in Britain. She attributed this to a Micoquian style of manufacture, although later authors have noted a lack of coherency in the definition of Micoquian technology and the inconsistency in age between Wolvercote and continental Micoquian sites (Ashton, 2001). There are 75 handaxes in total listed as

coming from the Wolvercote Channel (Roe, 1981), although they are distributed amongst several collections (Wymer, 1968). The mix of raw material types (quartzite and flint) from one assemblage presents the opportunity to examine the variable strategies employed when dealing with raw material shortages. Wolvercote is also one of the sites studied in White (1998a) and so affords another comparison within the present study. Roe (1981) attributed Wolvercote to Group III – Pointed – Plano-Convex, of which it was the only member.

Data Collection: The dataset consists of 34 handaxes recorded by hand, 27 of which are flint, seven quartzite, stored at the Pitt Rivers Museum. The remainder of the assemblage has been recorded by Tyldesley (1986), the data for which is available for analysis in this study.

Summary: The Wolvercote handaxes are believed to be in primary context at the base of a channel incised into the Wolvercote Terrace and Oxford Clay (Wymer, 1999). The assemblage contains some uniquely shaped and worked handaxes that are made of flint in an area where locally available good flint is scarce (MacRae, 1988). The presence of quartzite handaxes also affords another avenue of study.

4.4.5 RED BARNS, PORCHESTER, HAMPSHIRE (SU 608 083)

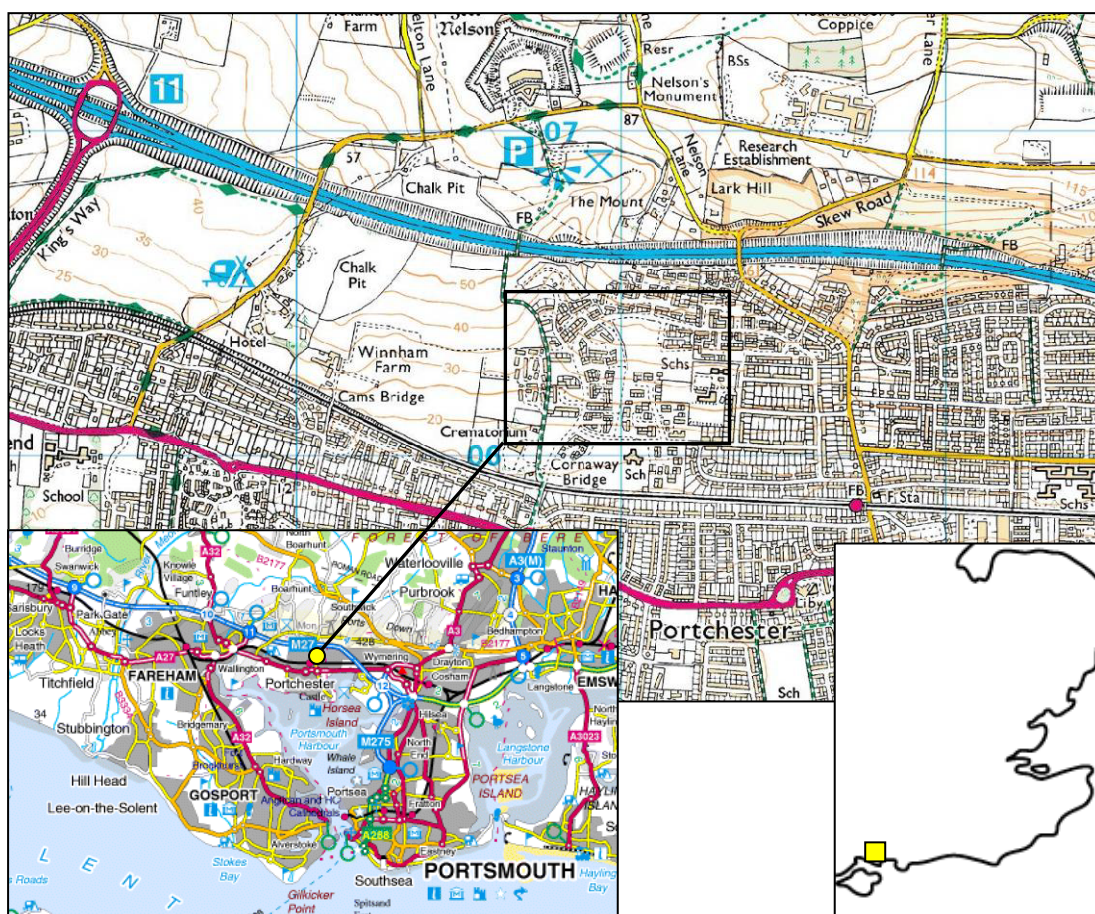


Figure 4. 28 - Map of Red Barns Site, Porchester and surrounding area and outline map showing Porchester area in South-Eastern England. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: The site of Red Barns was excavated in 1975 by Draper under the auspices of the South Hampshire Archaeological Research Group (SHARG) with the results published in brief over a decade later (Gamble and ApSimon, 1986). The area was identified as of potential interest in the 19th Century (Prestwich, 1872) and subsequently in 1972 (ApSimon *et al*, 1977) due to the presence of raised beach deposits. In 2000, the results of a new analysis of all the material from Red Barns were published (Wenban-Smith *et al*, 2000). The site itself is situated upon chalk deposits on the side of Ports Down Hill on the outskirts of Portsmouth. The flint artefacts were recovered at a density of over 100 per m² (Wenban-Smith *et al*, 2000)

and comprised all stages of manufacture from primary to finishing flakes (Gamble and ApSimon, 1986).



Figure 4. 29 – Annotated photograph of the stratigraphy at Red Barns (Taken from Past: The Newsletter of the Prehistoric Society, Number 33, 1999, Fig. 4).

Unit 10 – Cemented Breccia

Unit 101 - Chalky Breccia

Unit 11 – Grey Loam

Geological and Stratigraphic Context: The artefacts were found both within and below a cemented breccia (Unit 10) deposit, under successive brickearth and loam deposits. The grey loam (Unit 11) (Figure 3.33) from which the majority of artefacts were recovered also contained mollusc remains and was deposited above a poorly sorted chalk rubble deposit (Unit 12) ranging from 40 to 5cm thick, which contained a number of flint pebbles and a large quantity of sub-angular gravel clasts,. Unit 12 was deposited in a cold environment, and contains frost-fractured flint nodules. The lack of marine and fluvial terrace deposits makes it impossible to associate the stratigraphy at Red Barns with that of other sites in the area, such as Boxgrove, although the lower height of the deposits means that Red Barns must be younger than Boxgrove, dating between MIS 11-7 (430,000-180,000) (Wenban-Smith *et al*, 2000).

Environment, Fauna and Flora: As there were few recoverable pollen samples in the sediments from 1975 and none from the grey loam, there can be very little inference about environmental conditions in the surrounding area. The ostracod specimens were again limited but indicated a lack of marine species. Due to a poor state of preservation, faunal remains from Unit 11 are scarce. Remains of horse and another unidentified large mammal suggest a date between MIS 11 and MIS 7 due to a lack of comparably sized specimens before and after these dates. An abundance of mollusc remains were recovered from Unit 11. While most were not indicative of climate, some were only found in temperate conditions and others had a grassland tolerance. The high numbers of different species are indicative of temperate open grassland but not in a fully stadial condition (Wenban-Smith *et al*, 2000). The molluscan remains provided material for amino acid dating which indicated a possible date of MIS 7 that could not be determined with any certainty. The dating of the site is partially clarified by Unit 42, a brown clay loam higher up in the sequence which is comparable to other deposits of MIS 7 age. The grey loam is therefore considerably older (Wenban-Smith *et al*, 2000).

Lithic Assemblage Potential and Rationale: The archaeological material at the site is similar in type to the Wolvercote handaxes, in that a number exhibit a plano-convex profile. Although typology cannot be relied upon to produce a relative dating system, Wenban-Smith (in Wenban-Smith *et al*, 2000) believes that the two industries are closely related and, combined with other dating indicators, states that an MIS 9 date is most likely. The lack of a convincing Levallois component also points to a pre-Levalloisian MIS 8 date which makes the dataset from Red Barns an appealing comparator to Wolvercote, not just in date but also in style. The supposed uniqueness of the slipper-shaped plano-convex handaxes at these two sites makes the

study of these handaxes necessary to assess both the functional and aesthetic properties of these types of handaxes. The difference between the two sites in terms of raw material quality can also be examined to look at differing strategies for dealing with raw material shortages.



Figure 4. 30 - Photograph of Red Barns plano-convex handaxe (L11.289). Photo: KE.

Data Collection: The dataset for Red Barns consists of 5 flint handaxes measured by hand, from the British Museum Stores (Franks House). This sample contains all of the artefacts that can convincingly be attributed as handaxes.

Summary: The handaxes from Red Barns can be roughly attributed to MIS 9 and are part of an extensive collection of flint artefacts from beneath a sealed deposit. Although few in number, the presence of well-worked plano-convex handaxes, and also several tips that allude to a more substantial number, provides a good comparative site to Wolvercote. The environmental data, whilst scant, is sufficient enough to draw parallels with other temperate sites.

The British Early Middle Palaeolithic encompasses the timescale from 290,000 to 180,000 BP (MIS 8-7), incorporating the changeover from handaxe to Levallois dominance. It also represents the latter half of the Wolstonian/Saalian.

4.5.1 MIS 8 – UNNAMED GLACIAL PERIOD

This glacial period from 290-230,000 BP corresponds with the Wolstonian 2 Period described in Jones and Keen (1993) and is represented by the later stages of the Saalian in North-West Europe (Gibbard and Kolfschoten, 2004). This is thought to correspond with the higher levels of the Lynch Hill terrace and the base of the Taplow terrace (Wymer, 1999). The MIS curve shows several large fluctuations in temperature between MIS 9 and 7 which may explain the presence of archaeological sites, previously unseen during glacial periods, within temperate interludes in MIS 8. The smaller spread of the glaciation, combined with a low sea level (Jones and Keen, 1993) may also be contributory factors. The figure below shows the hypothetical extent of the Wolstonian glaciation in MIS 8/6:

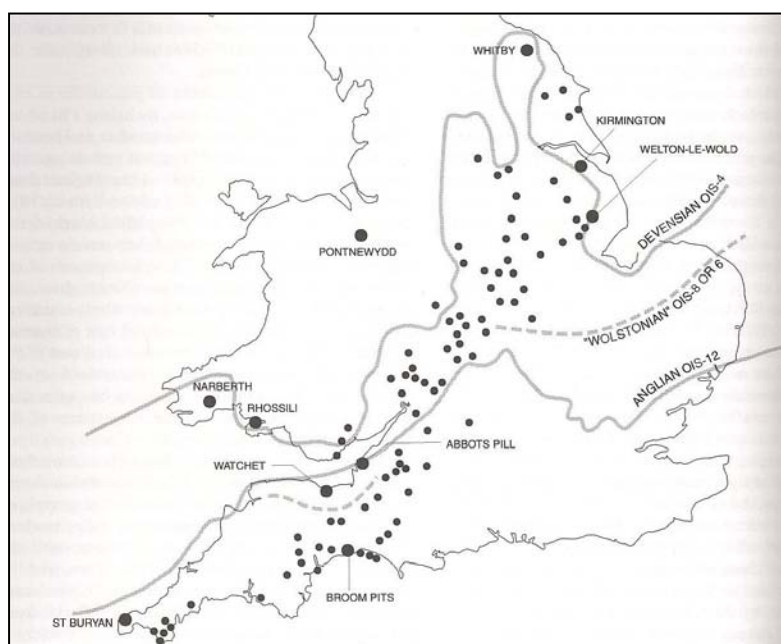


Figure 4. 31 – Map of England showing the hypothesised limit of the Wolstonian glaciation across East Anglia and the Midlands (Adapted from: Wymer, 1999, 116).

4.5.2 BROOM, AXMINSTER, DORSET (ST 325 022)

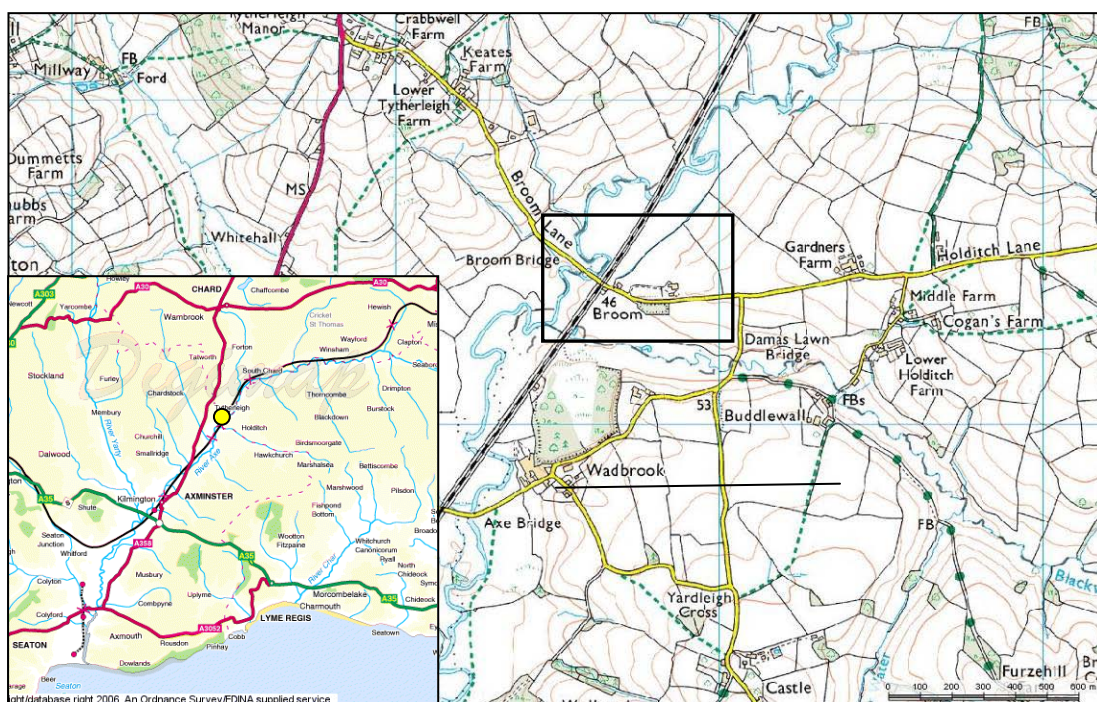


Figure 4. 32 - Broom Pits and Axminster and surrounding area. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: The systematic investigation of Broom Pits, Dorset, was undertaken by Bean, an amateur archaeologist, in the early 1930s (Green, 1988). The site is located in the River Axe valley at the Devon/Dorset border and is the most prolific in south-west Britain (Hosfield and Chambers, 2002). Three gravel pits, Ballast, Pratt's Old/New and Kings Pit, produced 1800 handaxes made of high quality chert and are described as mostly *in situ* (Roe, 1968, Wymer, 1999). The site was investigated again in the 1980s (Shakesby and Stephens, 1985) and more recently by Hosfield and Chambers (2002). The most recent fieldwork programme included optical dating tests which dated the artefact-bearing horizons to 250-270,000 BP, a mid-MIS 8 date.

Geological and Stratigraphic Context: The sequence of deposition at Broom Pits is described by Green (1988) based on the photographs and descriptions recorded by Bean. There is no detailed diagram of the stratigraphic superposition at Broom (save

for Hosfield and Chambers (2002) which is not linked to Bean's stratigraphy), but the sediments can be divided into three distinct groupings. Firstly, the Lower Gravels of somewhat irregular depth, composed of regular bedded gravels of small clasts. Secondly, the Middle Beds, a combination of several thin, fine-grained sediments in which sand, clay and loam were common (Green, 1988). Juxtaposed within these beds were several layers of red stained deposits, characterised by Hosfield and Chambers (2002) as manganese horizons. Finally, the Upper Gravels, which are similar in type to the Lower Gravels, but less regularly bedded, consist of sediment containing lenses of green sand with a total thickness of up to 9m in places. They are most likely associated with fluvial deposition from the River Axe, deposited in low-energy environments in a series of pools and channels running through the floodplain. The provenance of the Broom handaxes was mostly taken from the information provided by the workmen who collected them. This record indicates that the majority of artefacts were recovered from the Middle Beds with a predominance of finds occurring in the manganese horizons.

Environment, Fauna and Flora: The sediments excavated indicated a series of climatic fluctuations contrasting with periods of relative stability that lead to the formation of landsurfaces. These landsurfaces are represented by the manganese/ironpan layers, although these appear to have been short-lived episodes (Hosfield and Chambers, 2002). The dating of the Middle and Upper Beds at Broom to mid MIS-8 correlates with a short warming period in the midst of the glacial stage evidenced from the Vostok ice-core (Petit *et al*, 1999), suggesting that the climate may have ameliorated sufficiently to tempt hominins into the southern areas of Britain. There are no floral or faunal remains attributable to this site.

Lithic Assemblage Potential and Rationale: 97% of the handaxes are made from chert, the rest are flint, with 81% in a sharp or very sharp condition (Green, 1988). The source of raw material is likely to be upstream from the site, where the River cuts through and exposes chert deposits (Hosfield and Chambers, 2002). The site is interesting for its lack of Levallois technology, despite abundant good raw material sources, in a period where Levallois is commonly found. The large number of handaxes recorded at the site, and the likelihood that they were deposited over a short period of time in primary context (Wymer, 1999) makes them a viable target of study.

Data Collection: Broom was selected for the current study due to the availability of the Marshall database assemblage of 253 handaxes, combined with the availability of 16 handaxes in the Cardiff Museum to measure by hand.

Summary: The handaxes from Broom may not have been excavated by conventional methods but they have been well recorded and come from a fairly secure context that was deposited over a short period of time. They are numerous, well made and are interesting for their lack of a Levallois component. Stratigraphic work suggests that the depositional context was a short-lived landsurface in the midst of a floodplain environment. Dating of the site places it within MIS 8.

4.5.3 MIS 7 – THE AVELEY INTERGLACIAL

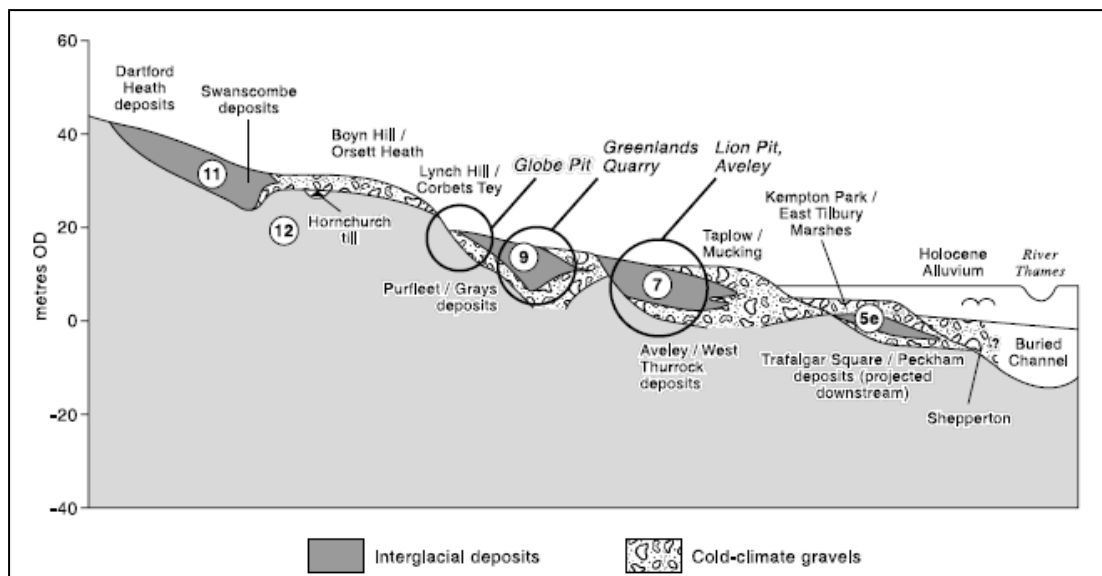


Figure 4. 33 - Cross-section of the Thames Valley deposits – showing the location of the MIS 7 deposits at Lion Pit, Aveley adjacent to the gravel deposits of the Taplow/Mucking Terrace. Taken from Bridgland *et al* (2003).

The Aveley Interglacial, named after the type-site at Lion Pit, Aveley, in Essex, is substantially more researched than the preceding cold stage (Bridgland *et al*, 2003). This is due particularly to the work of Schreve (2001a, 2001b, 2004; Candy and Schreve, 2007) at a number of sites in Britain containing MIS 7 deposits. The use of biostratigraphic and dating techniques has produced a detailed picture of a stage that fluctuates dramatically throughout, providing a range of different environments and faunal assemblages for hominin exploitation (Candy and Schreve, 2007).

The diagram below (Figure 4.34) clearly shows a distinctly changing climatic regime, fluctuating from cold to warm climates throughout the duration of MIS 7. This has important implications for the nature of the environment that hominins were inhabiting throughout this period.

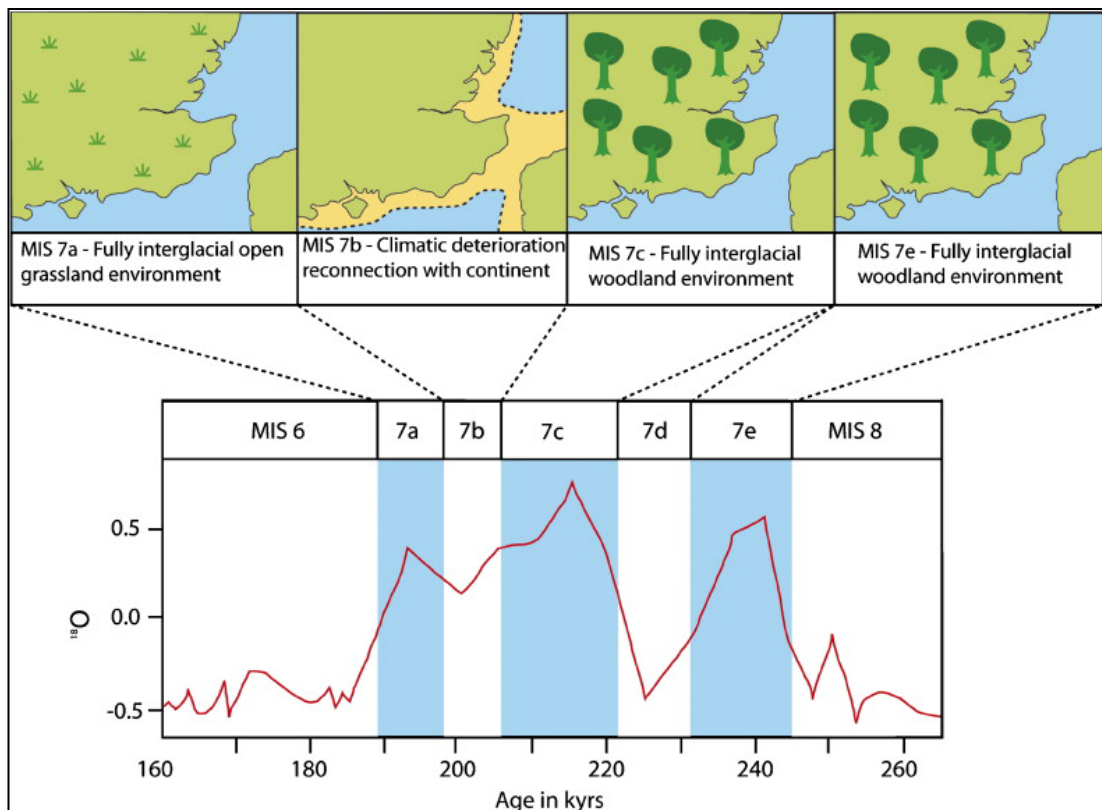


Figure 4. 34 - Diagram showing the posited environmental fluctuations in South-Eastern England during MIS 7. Taken from Candy and Schreve (2007, 1232).

Faunal remains from Aveley include a predominance of horse, alongside woolly mammoth, straight-tusked elephant and rhinoceros. The faunal suite of animals at sites pertaining to MIS 7 and the subsequent Ipswichian period (MIS 5e) has been instrumental in distinguishing sites of different ages where stratigraphic controls cannot be utilised (Schreve, 2001a). The biostratigraphic remains at Aveley represent two completely different temperate faunal suites, named by Schreve as the Ponds Farm and Sandy Lane Mammal Assemblage Zone. Within the Ponds Farm assemblage, the possibility of two separate faunal assemblages both suited to temperate woodland has been suggested (Schreve, 2001b). The Sandy Lane assemblage contains animals more suited to open grassland. This suggests that the Ponds Farm woodland assemblage can be attributed to MIS 7e and 7c, with the grassland environment from the Sandy Lane Zone occurring within 7a (Candy and Schreve, 2007).

4.5.4 PONTNEWYDD CAVE, CLWYD, WALES (SJ 013 710)

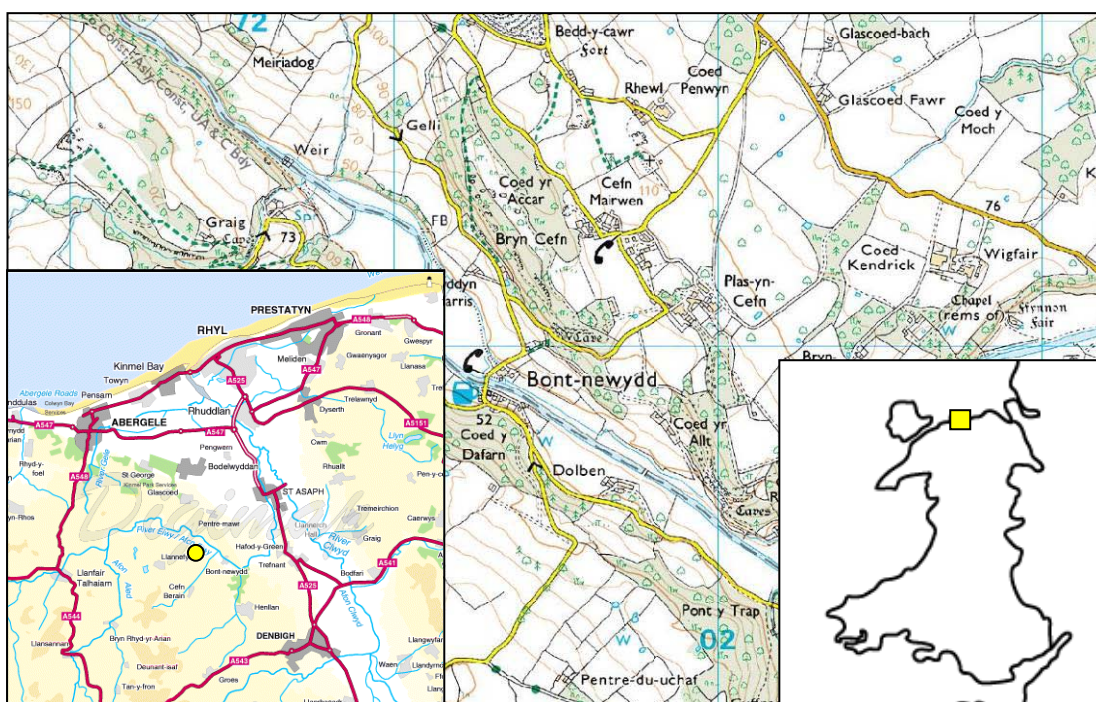


Figure 4.35 - Pontnewydd Cave and surrounding area. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: The site of Pontnewydd Cave is notable for being one of a handful of Lower and Middle Palaeolithic sites located outside the south-east of England. Green (1984) believes that the geographical isolation of the site is not a true archaeological signature but is the result of the destruction of contemporaneous sites by subsequent glaciations. Radiocarbon and thermoluminescence dating indicate that the artifact-bearing horizons of the Lower Breccia and the Buff Intermediate are older than 225,000 BP. The archaeologically sterile layers located immediately below are dated to pre-250,000 BP, placing the site tentatively within MIS 7 (Green *et al*, 1987). The assemblage represents a mix of finds from early 20th century investigations together with more recent controlled excavation. The excavated and collected material contains the remains of hominins with early Neanderthal affinities, a lithic assemblage containing both Levallois and handaxe components and a representative faunal assemblage. The identification of hominin bones attributable to *Homo*

neanderthalensis were seen as similar to the Krapina Neanderthals and therefore supporting an MIS 7 age (Stringer, 1984) however the Krapina specimens have since been redated to 130,000 BP (Rink *et al*, 1995). Evidently the associated dating evidence does not demonstrate that the artefacts were manufactured at this time, merely that they were deposited during MIS 7, although a burnt flint core from the deposits has been dated to 220,000 BP providing more substance to the MIS 7 date.

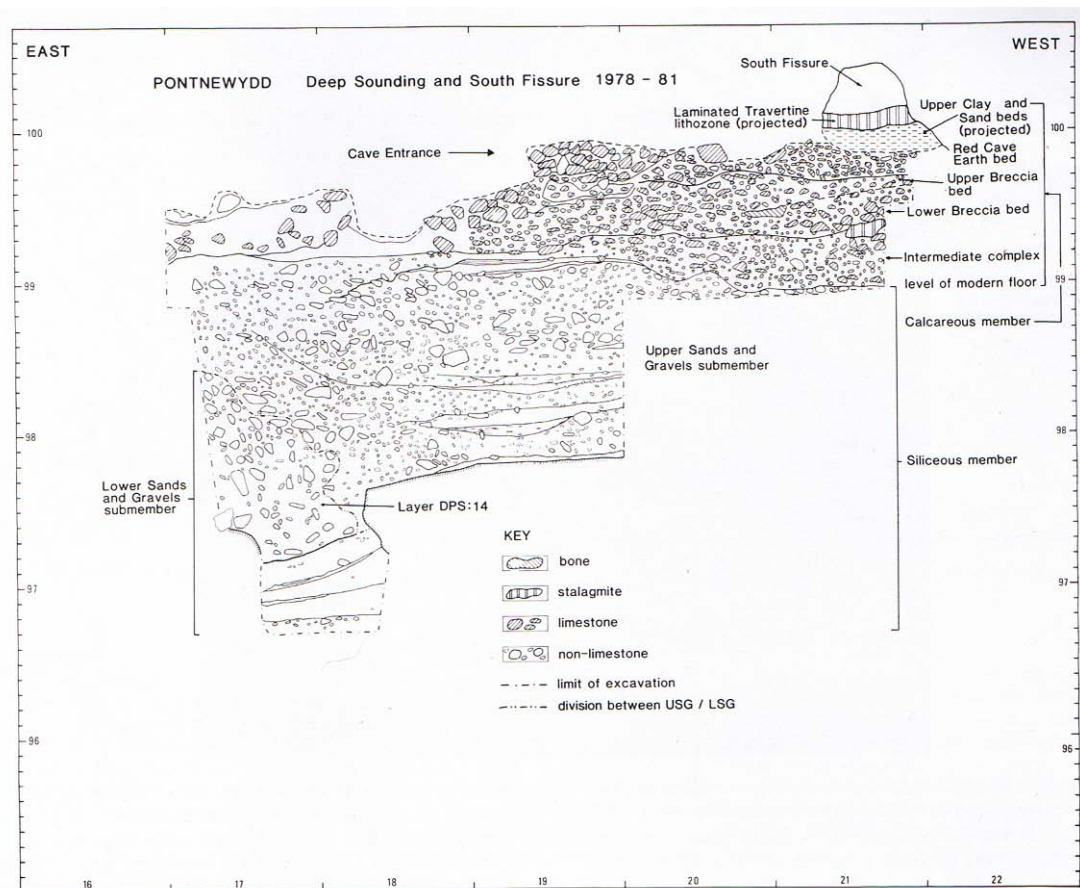


Figure 4. 36– Stratigraphic diagram from one section of Pontnewydd Cave (Taken from Green, 1984, 36).

Geological and Stratigraphic Context: The process of deposition in the cave is believed to have occurred via several debris flows combined with some *in situ* deposit formation. The archaeology is therefore mainly deposited in secondary contexts within debris flows originating externally from the cave. Accumulation of material in the cave is believed to be from a mix of hominin, carnivore and natural action. There are several sequences of deposition within the cave, but the levels with

which this research is concerned are the Intermediate complex (Ic) and the Lower Breccia (LB) from which the majority of the finds were recovered and they are dated to the period of interest. The dating evidence, combined with MIS records suggest that the deposition of the Intermediate complex and the Lower Breccia took place at the end of the MIS 8 glaciation and the beginning of the Aveley Interglacial (MIS 7).

Environment, Flora and Fauna: While climatic conditions cannot be inferred for every stratigraphic unit, faunal remains indicate that the climate in which the hominin presence occurred was a colder, steppic environment with limited woodland cover (Currant, 1984). Faunal assemblages from Ic and LB are not markedly different, containing wolf, hyena, horse and rhinoceros amongst others. The major differentiation between the two layers is the absence of woodland/scrubland mammals in the LB. There is the possibility that the LB fauna is more representative of a colder, deteriorating environment. Both faunal assemblages indicate the presence of flowing water nearby (Currant 1984). There are no observable cut marks on the faunal remains which mean they cannot be associated with the hominin presence. Much of the assemblage was transported into the cave and there is considerable fragmentation and weathering of the bones. Gnawing and accumulation of faunal remains inside the cave also indicates that carnivore activity has played a role (Green *et al*, 1987).

Lithic Assemblage Potential and Rationale: There is a substantial lithic assemblage at Pontnewydd, with a Levallois component at Pontnewydd. The predominant raw material types are locally collected glacial erratics (rhyolite, fine silicic tuff, ignimbrite, basalt, dacite) with a 10% flint component.



Figure 4. 37 – Sample handaxe from Pontnewydd (rhyolite). Photo: KE.

Alongside handaxes, a number of flint tools and cores complete the assemblage. The site was selected for inclusion in the current study for several reasons: firstly, it was seen as a site with which to compare the Great Pan Farm assemblage (see below); secondly, its isolated geographical position allows for the study of hominin behaviour on the margins of British colonization; and finally, the use of non-flint raw materials provides an opportunity to examine how hominins were utilizing different raw material types.

Data Collection: The 32 handaxes came from the Cardiff Museum collection and represent all the handaxes from the Lower Breccia/ Intermediate Complex horizons. The handaxe data is supplemented by measurements of all other flint artifacts from these horizons.

Summary: The site of Pontnewydd presents itself as a site of great interest for this study. This is due to its location, lithology and temporal position. The use of Levallois components alongside traditional handaxes affords the opportunity to study the effects of this juxtaposition. This is complemented by the possibility of

examining how handaxes are manufactured on partly–intractable raw materials and the effect this has on form and function. There is also a good comparative dataset from Great Pan Farm (see below) featuring many of the same components, also dated to MIS 7 (Roberts, Pope and Russell, 2006).

4.5.5 GREAT PAN FARM, SHIDE, ISLE OF WIGHT (SZ 507 884)

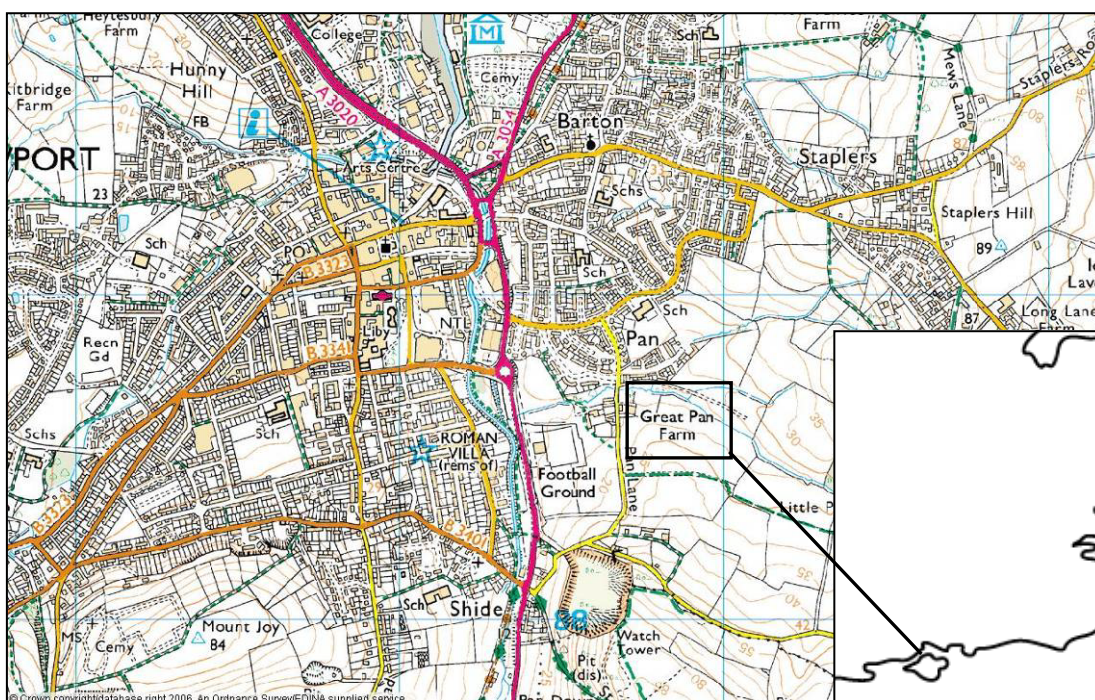


Figure 4. 38 - Great Pan Farm and the Isle of Wight. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: The site at Great Pan Farm (GPF) is situated adjacent to the east bank of the River Medina, to the south-east of Newport, Isle of Wight. The assemblage from Great Pan Farm was collected at the end of the 19th Century by Poole (1925) during the process of gravel extraction. The assemblage is roughly contextualised but some objects are unstratified. The date of the site is uncertain, with dates between MIS 9 and MIS 3 possible. However, the dating has recently been reassessed and work on the stratigraphy and the lithic assemblage suggests a MIS 7 date (Roberts, Pope and Russell, 2006).

		MATERIALS AND FOSSILS.	VARIATION IN THICKNESS	AVERAGE THICKNESS	IMPLEMENT
TOTAL DEPTH VARIES FROM 6' TO 8' 3". AVERAGE OF 20 SECTIONS 6' 10".	VII.	SOIL.	6" to 22"	15"	NIL.
	VI.	CLAYEY RAINWASH WITH SCATTERED FLINTS WATERWORN AND ANGULAR UNSTRATIFIED.	6" to 20"	12½"	BRONZE PALSTAVE
	V.	WHITE GRAVEL WATERWORN AND ANGULAR	4" to 12"	7"	THAMES PICK
	IV.	UPPER YELLOW GRAVEL WATERWORN AND SUB-ANGULAR, CURRENT BEDDED BLACK BAND AT TOP.	15" to 23"	15½"	MOUSTERIAN ACHEULEAN II
	III.	GREENISH-GREY CLAYEY SAND. PLANT REMAINS.	1" to 11"	5"	MOUSTERIAN ACHEULEAN II ? LA MICOQUE
	II.	LOWER YELLOW GRAVEL WATERWORN AND SUB-ANGULAR, CURRENT BEDDED WITH SHINGLY AND SANDY BANDS AND POCKETS. SARSENS.	18" to 42"	29"	MOUSTERIAN ACHEULEAN II ACHEULEAN I LATE CHELLEAN ROLLED (DERIVED)
	I.	BLUISH SANDY CLAY WITH UNEVEN UPPER SURFACE. TEETH OF ELEPHAS ANTIQUUS AND CAST OF MOLLUSC. (? LIMNÆA).	HAS BEEN EXPOSED TO 13"	SELDOM EXPOSED	ACHEULEAN II
DIAGRAM SHOWING THE PRINCIPAL FEATURES OF THE BEDS AT PAN PIT, SHIDE, ISLE OF WIGHT, COMPILED FROM 20 MEASURED SECTIONS. H.F.P.					

Figure 4. 39 - Poole's stratigraphic sequence of Great Pan Farm (Taken from Poole, 1925, 308).

Geological and Stratigraphic Context: The stratigraphic sequence recorded by Poole (1925) and confirmed by Shackley (1973) is a mixture of sand, clay and gravel deposits recorded across the site in various forms. The main body of artefacts were recovered from the Upper and Lower Yellow Gravels, with artefacts occurring in all levels of the sequence. The two gravels are separated by a layer of beach sand. The

Lower Yellow Gravels (Bed II) contain fragments of worn flint, Upper Greensand chert and quartz. Bed III, the greenish-grey beach sand, contained the finest of the ovate handaxes and is overlain by the Upper Yellow Gravels (Bed IV), a flinty, angular gravel. Poole (1925) assigned a different flint-making tradition to each layer, from Chellean to Mousterian.

Environment, Flora and Fauna: There is a limited amount of non-diagnostic faunal data. A reassessment of the palynological evidence has recently taken place: The preservation of pollen near the site was poor and the presence of grass and conifer pollen may have been due to later introduction. An abundance of dinoflagellate cysts indicates the deposition of the organic clay element took place in a saline environment, although it is unlikely to have been fully marine (Roberts, Pope and Russell, 2006).



Figure 4. 40- Example of a GPF handaxe. Photo: KE.

Lithic Assemblage Potential and Rationale: There are a large quantity of handaxes in the collection, together with flake tools, choppers, Levallois cores and debitage,

and a quantity of unretouched flakes. The artefacts from GPF are not made on the same flint as is found in the deposits (Shackley, 1973). The assemblage offers the opportunity to assess the role of handaxes within an assemblage of other tool types. It was one of the sites studied by Roe (1968) but he only records 44 handaxes, whilst the current total recorded by the present author is 83. This allows for a better assessment of the overall shape profile of GPF, currently assigned to Group VI – Ovate (more pointed) (Roe, 1968). Although there is a component of the assemblage that is unstratified, meticulous recordkeeping by Poole (1925) means that a large proportion of the assemblage can be attributed to a particular stratigraphic layer. I was fortunate to have studied this assemblage in full as part of an evaluation (Roberts, Pope and Russell, 2006) and believe that the attribution of the site to MIS 3 is incorrect. The assemblage was assigned to MIS 3 on the basis of a single bout coupé which cannot be conclusively demonstrated to be contiguous with the remainder of the assemblage. The overall composition of the assemblage is very similar to Pontnewydd and, combined with the revised stratigraphic context, assigns the GPF assemblage to MIS 7. Therefore, the site serves as an intermediary between the Lower Palaeolithic assemblages and the Late Middle Palaeolithic and as a contemporary for Pontnewydd.

Data Collection: The data from this site consists of 83 complete flint handaxes, all recorded in person at the Council Museum Store, Isle of Wight Museum Services. The dataset for the complete lithic assemblage was collected at the same time.

Summary: The site of Great Pan Farm has been the subject of previous study by both Shackley (1973) and Roe (1968) and contains a good selection of handaxes and other tool-types collected from a gravel extraction pit. Recent re-examination of the

site by the author and others (Roberts, Pope and Russell, 2006) indicates that the site is earlier (MIS 7) than previously assumed (MIS 3) and it therefore has untapped potential as a key site in understanding the transition away from handaxe-dominant assemblages and into Levallois-dominant technology.

4.5.6 STANTON HARCOURT, OXFORD, OXFORDSHIRE (SP 415 055)



Figure 4. 41 - Stanton Harcourt and the Oxford area. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: Stanton Harcourt is another site situated within the Oxford area, and is dated to MIS's 6 and 7, with the bulk of material deriving from the MIS 6 gravels, although they are likely to have been created during the warmer MIS 7 (Wymer, 1999). Stanton Harcourt is thought to be approximately 18km north of the nearest raw material source (Hardaker, 2001).

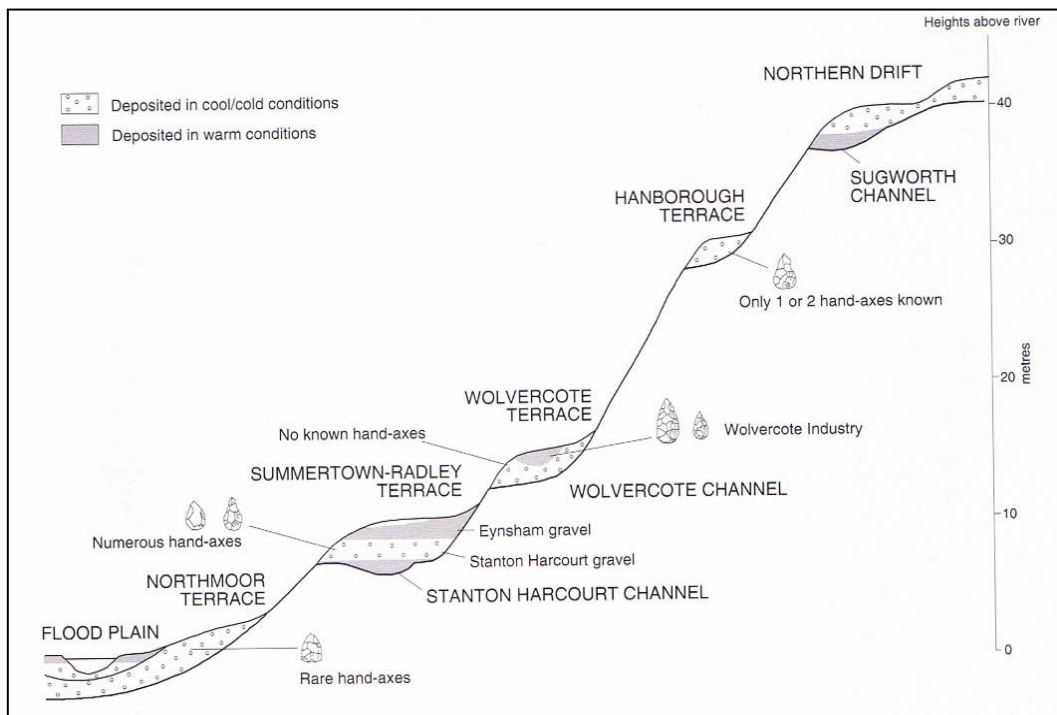


Figure 4. 42 - The Upper Thames terrace sequence and associated archaeology (Wymer, 1999, 56).

Geological and Stratigraphic Context: The stratigraphy of the Stanton Harcourt sequence has been much studied by Scott and Buckingham (1996, 1997 and 2001). With a stratigraphic position below that of the Wolvercote Channel the gravels and channel deposits at Stanton Harcourt definitely postdate MIS 9 but until recently the exact age was not clear. Scott and Buckingham (2001) attribute the Stanton Harcourt Channel to MIS 7, and the gravels directly above to MIS 6. They believe the gravels to have been deposited by river action in MIS 6 which either led to the incorporation of early MIS 6 artefacts into the deposits, or led to the erosion of MIS 7 deposits, leading to MIS 7 artefacts being reworked into MIS 6 deposits. The latter is their preferred theory.

Environment, Flora and Fauna: The MIS 7 climate, within which the Stanton Harcourt Channel deposits were laid down, is characterised as a mild interglacial, with temperatures similar to those of today. A riverine environment, found in combination with forested and grassland areas, is indicated with mammoth, elephant, bison and horse representing the main faunal suite. In contrast, MIS 6 is

characterised as a period of intense cold, with little or no organic remains preserved. The possible close proximity of the ice sheet in this period leads Scott and Buckingham (2001) to surmise that occupation of the Stanton Harcourt channel at this time was unlikely.



Figure 4. 43 - Example of a Stanton Harcourt flint handaxe. Photo:KE.

Lithic Assemblage Potential and Rationale: Stanton Harcourt lies in an area devoid of natural flint resources. The gravels combine limestone and quartzite pebbles (MacRae, 1991). The handaxes recorded for this study were all collected by MacRae through commercial gravel extraction at Gravelly Guy (SP 402 055) and Linch Hill Pits (SP 415 043). This means they are only roughly contextualised, although they were recorded by an experienced flint enthusiast (MacRae, 1991). The artefacts are lightly rolled but extremely patinated. There has been substantial investigation of the site since the mid-1980s which has yielded only four flakes, indicating a lack of handaxe manufacture onsite. MacRae (1988) also notes that there is the possibility of some handaxe fragments being worked into smaller tools which raises the idea of recycling taking place here. This is contradicted however by the find of a 27cm 'giant' handaxe which is not indicative of raw material conservation

at all. Again, the influence of raw material quality on handaxe production can be assessed. The chronological separation and geographical similarity of Wolvercote and Stanton Harcourt, also provides an opportunity to assess the relative strategies for procurement, manufacture and use of handaxes at these sites.



Figure 4. 44 - Example of two Stanton Harcourt quartzite handaxes. Photo KE.

Data Collection: The dataset from Stanton Harcourt consists of 29 handaxes recorded personally at the Pitt Rivers Museum Store, Oxford, 5 of which are made from quartzite, the remainder from flint.

Summary: The site of Stanton Harcourt is a more recently discovered site which has more qualifying stratigraphic and environmental data than many of the other sites in this study. The material is not exceptionally well provenanced, but the substantial research done by Scott and Buckingham (1996, 1997 and 2001) in recent years allows for a more comprehensive view of the age and environment of the Stanton

Harcourt deposits. The proximity to the other Oxford sites is the most interesting factor, allowing for comparison with sites of different ages and use of raw material. It will also be possible to make inter-assemblage comparisons between flint and quartzite handaxes.

4.6 UNDATED LOWER/EARLY MIDDLE PALAEOLITHIC SITES

The following sites all have age estimates that place them within the Lower or Early Middle Palaeolithic. Due to aspects of stratigraphy or lack of information, it is not possible to correlate them any more closely than to two, or more, Marine Isotope Stages. Where possible, the probable dates for each site are discussed.

4.6.1 BIDDENHAM, BEDFORD, BEDFORDSHIRE (TL 024 508/ 020 500)

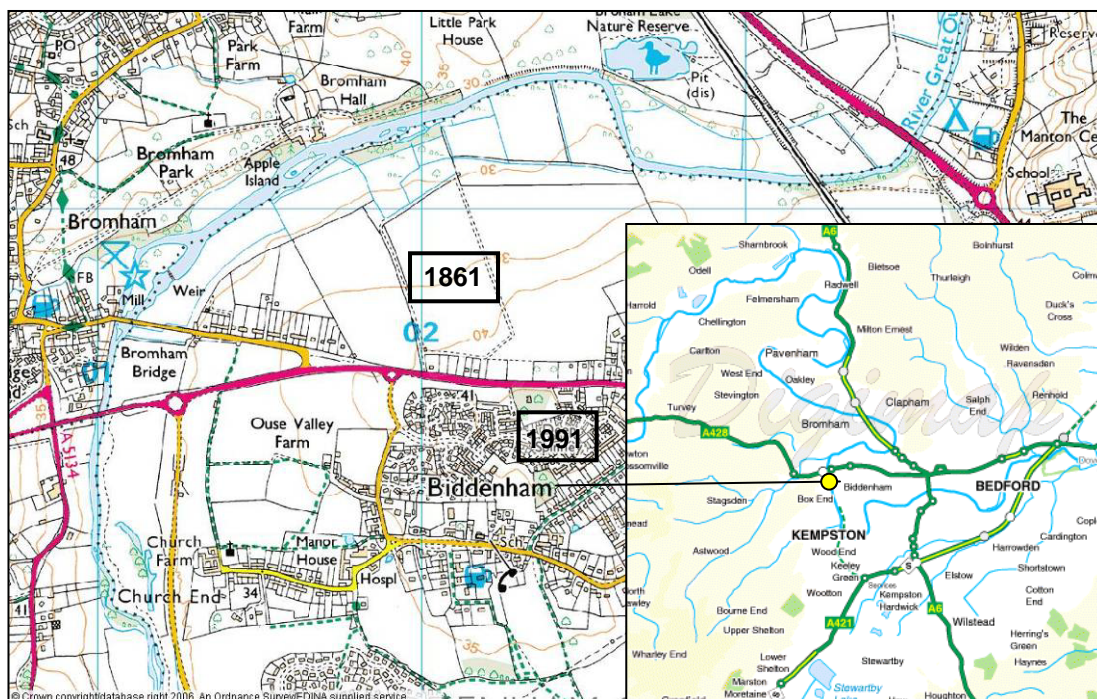


Figure 4. 45 - Biddenham and surrounding area. Location of 1861 and 1991 find spots is marked in black. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: Biddenham, located to the west of Bedford, was the first prolific handaxe site to be discovered in Britain. The first handaxes to be found in Britain were collected there by Wyatt (1861) and reported by Evans (1872) including one of the largest handaxes in Britain (Evans, 1872). A more recent excavation on the same site (Harding *et al*, 1991) provides a stratigraphic scheme for the artefacts.

Geological and Stratigraphic Context: Evans describes a two mile long deposit of drift gravel consisting of ‘subangular stones in an ochreous matrix’ (1872, 531), composed of flint, quartzite and sandstone. The site is located within a valley that cuts through layers of Jurassic Era Oxford Clay and Boulder Clay (an MIS 12 deposition). The more recent excavation (Harding *et al*, 1991) recovered artefacts in the levels immediately above the Oxford Clay in the highest terrace of the River Ouse. They associated the deposits to the Lynch Hill terrace of the Lower Thames

through assemblage composition, dating it to between MIS 10-8. The terraces of the River Ouse have not been studied in as great detail as those of the Thames and suffer from several uncertainties. Wymer (1999) noted that the temperate shell bed within which the artefacts were located must belong to either MIS 11 or 9, although it is possible that it represents a temperate period within MIS 8 or 10.

Environment, Flora and Fauna: Shells and other faunal material from the site indicated that the artefacts were deposited in a temperate climate (Wymer, 1999).

Lithic Assemblage Potential and Rationale: The site produced one of the largest

handaxes in the British Isles, the 'Big Boy of Biddenham' measures just over 24cm in length and was illustrated by John Evans (532, 1872). Roe (1968, 2) lists 304 handaxes from Biddenham, dispersed through several museum collections. The site was selected to form part of the current study on the advice of Roger Jacobi (*pers comm.*) who intimated that it would be of some relevance and interest to the author.

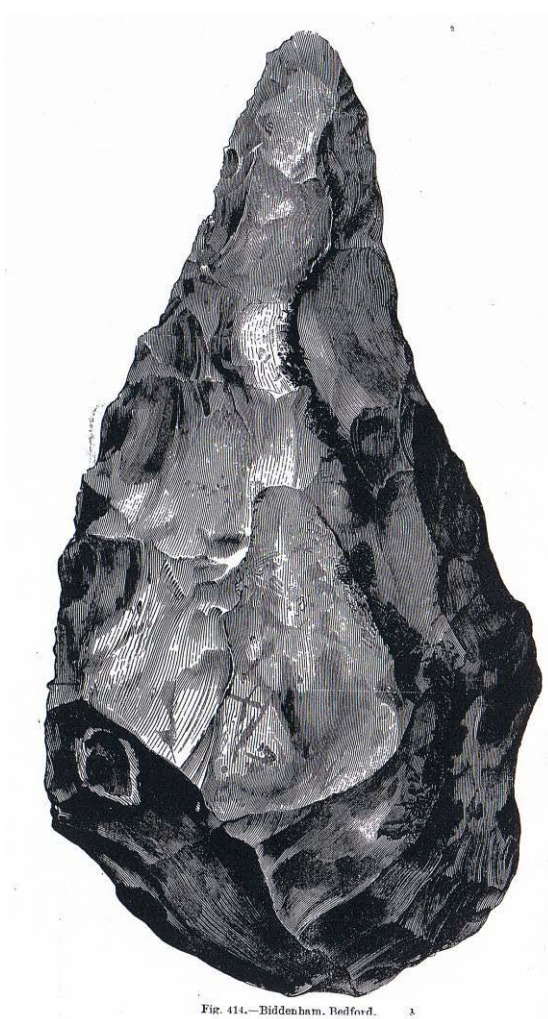


Figure 4. 46 – The 'Big Boy of Biddenham' as illustrated by Evans (532, 1872).

Data Collection: The 25 handaxes recorded from Biddenham formed part of the Wyatt Collection at the British Museum Stores (Franks House) and were selected at random.

Summary: The handaxes from Biddenham encompass a variety of forms and can be placed within a temperate climatic phase, probably MIS 9. They have symbolic value as the first handaxes to be discovered in Britain. The age and stratigraphic location provide another comparative assemblage for the other MIS 9 sites.

4.6.2 CUXTON, MAIDSTONE, KENT (TQ 710 665)

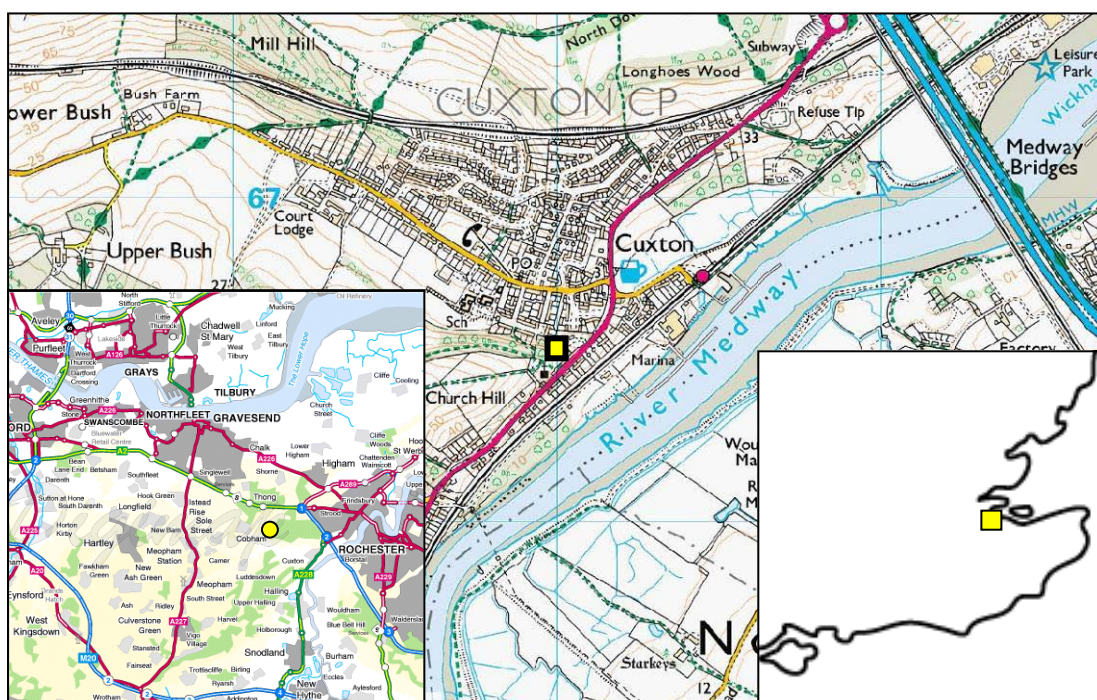


Figure 4.47- Cuxton and the Medway area. Yellow square marked on the map indicates the site of the 1962 and 2005 excavations. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: Cuxton is a Lower Palaeolithic site of no fixed date, although typologically it has strong early Acheulean affinities (Cruse *et al*, 1987). Handaxes were first discovered on the site in the late 19th Century and an area concentrated in the Rectory gardens was excavated in 1962 by Tester. The site was also re-examined on a small scale by Wenban-Smith (2004).

Geological and Stratigraphic Context: The artefact-bearing horizons at Cuxton relate to the 50ft terrace of the Medway Terrace. The artefacts were recovered from a gravel and sand deposit, overlain by a thick loam layer. Investigation by Cruse *et al* (1987) revealed that the origin of the gravels was fluvial, deposited by the River Medway.

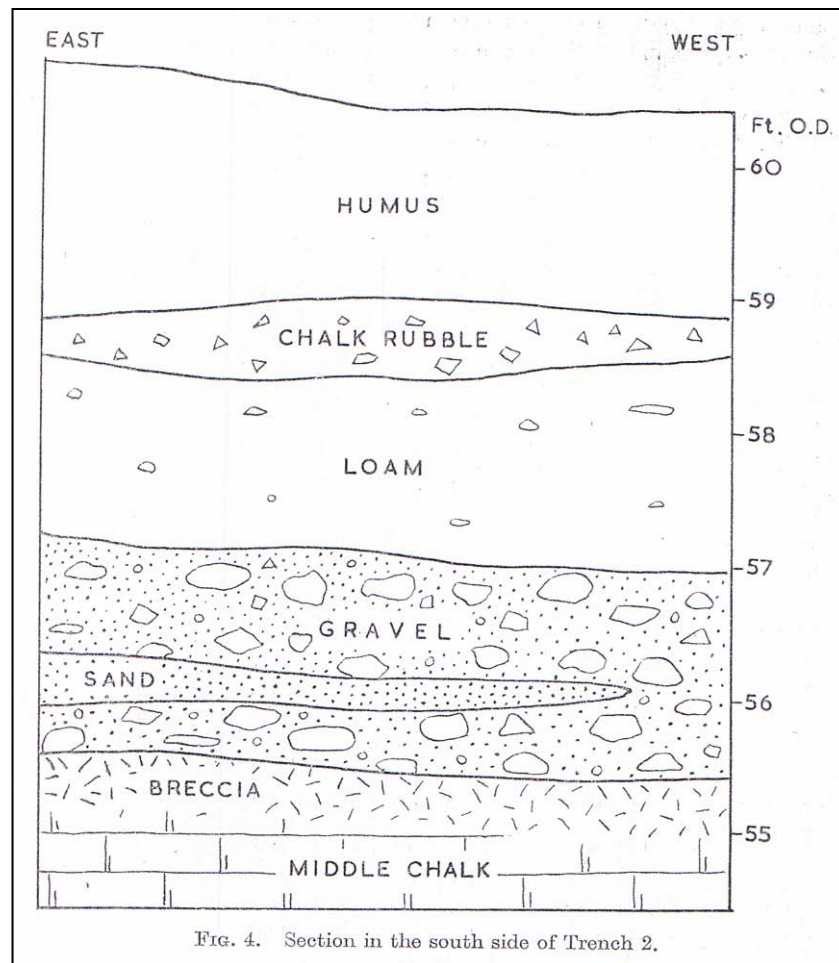


Figure 4. 48 - Stratigraphic diagram of Cuxton sediments (Taken from Tester, 1965, 36)

Environment, Flora and Fauna: The original 1962 excavation reported poor bone preservation, with no identifiable remains. Cruse *et al* (1987) improved slightly upon the faunal picture, with the recovery of small fragments of badly preserved bone, mostly unidentifiable, but several representing bison, horse and elephant. Wenban-Smith (2004) does not mention any recovered faunal remains. The faunal suite is undiagnostic and pollen analyses were not informative (Cruse *et al*, 1987).

Lithic Assemblage Potential and Rationale: A total of 657 flint artefacts were recovered in 1962/63 (Tester, 1965). This is supplemented by another 300 artefacts (15 handaxes) from Cruse *et al* (1987) and 20 handaxes (including two ‘giants’) from the 2005 excavation (Wenban-Smith, 2004). Handaxes from Cuxton are typified by

a long, pointed form with thick butts and refined tips. Roe (1968) placed them within Group I – Pointed with Cleavers. The data from this site has been included as the handaxes contained within the assemblage represent an extreme of handaxe production, heavily constrained by the local raw material. The emphasis here is on the handaxe as an individual object irrespective of date. Obviously, it will not be possible to include Cuxton in any chronological comparison of handaxe morphology, though it will be possible to look at manufacturing processes and patterning independent of dating constraints.



Figure 4. 49- Example of a Cuxton handaxe. Photo: KE.

Data Collection: The data from Cuxton consists of 30 handaxes measured and recorded personally from the British Museum Store, Frank's House, together with metrical data for the remainder of the assemblage taken from the Marshall database (Marshall *et al*, 2002).

Summary: Problems with dating have hindered the recognition of Cuxton as a site of great significance for the Lower Palaeolithic. The forthcoming results of OSL dating by Wenban-Smith will give the site the chronological stability that it requires.

Three excavations have taken place at the site, with hundreds of recorded finds (Tester, 1965; Cruse *et al*, 1987 and Wenban-Smith, 2004). The site of Cuxton is a certainty for inclusion in the present study for the unique shape and size of the handaxes contained within it, thought to evidence cultural expression by some (Wenban-Smith, 2004) and raw material constraints by others (Shaw and White, 2003).

4.6.3 BOWMAN'S LODGE, DARFORD, KENT (TQ 519 736)

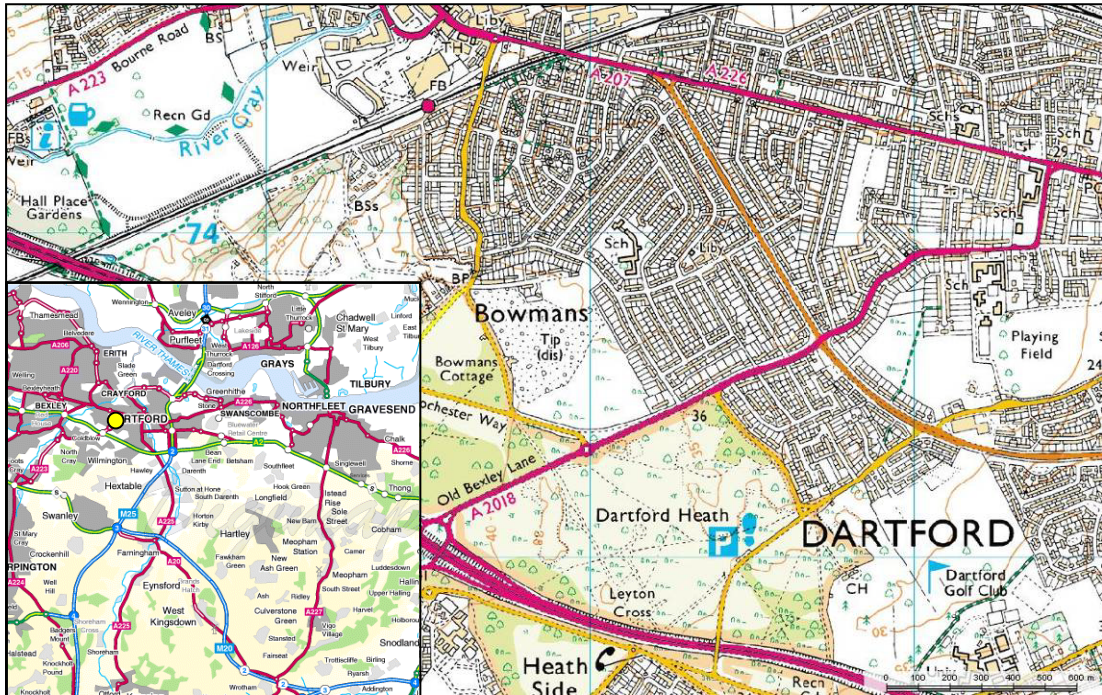


Figure 4. 50 - Bowman's Lodge, Dartford and the Medway area. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: The site of Bowman's Lodge, Dartford Heath, is another product of gravel/sand extraction. The site was monitored throughout extraction by Tester (1951) who recovered bifacial implements, cores and flakes from an expanse of gravel within the pit. Dating of the Dartford Heath Gravels is uncertain and could be attributed to any MIS temperate stage from 13-9 (Wymer, 1999) although it is most likely to be within MIS 11 (White *et al*, 1995).

Geological and Stratigraphic Context: The artefacts from Bowman's Lodge were recovered from the juncture between a 19-25ft expanse of gravel and a loam of variable depth (Tester, 1951). The relationship between this gravel and those from other areas of the Thames has yet to be established, leaving room for interpretation as to the age of the site.

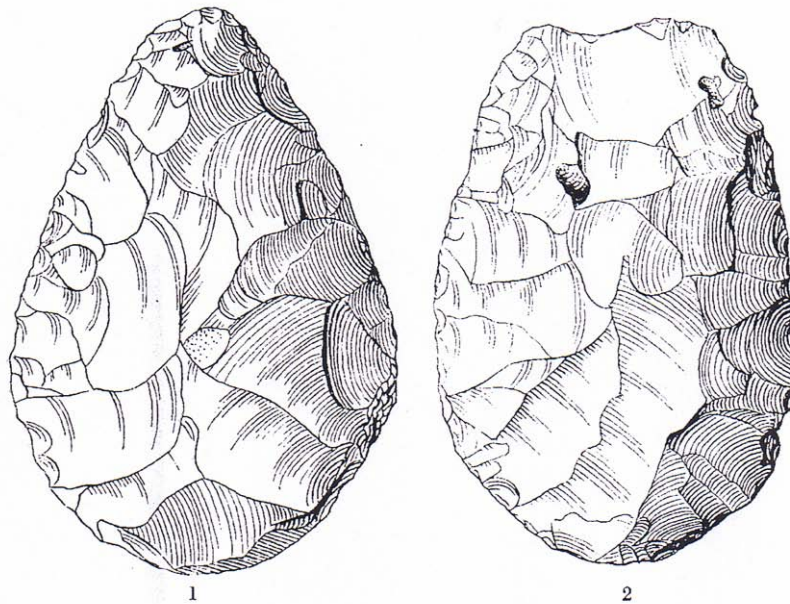


Figure 4. 51 - Two Bowman's Lodge handaxes. Taken from Tester (1951) page 123.

Lithic Assemblage Potential and Rationale: The assemblage was primarily chosen for its accessibility in the Marshall database. The handaxes recovered by Tester (1951) are in good condition and are likely to have been *in situ* (Tester, 1976). They were included in Roe (1968) within Group VI – Ovate – More Pointed. They were also included in White (1995). This affords the opportunity to compare analysis results and observations with other studies. Due to a lack of contextual information concerning age or environment, the usefulness of this assemblage will be in comparing handaxe with handaxe.

Data Collection: The assemblage consists of 29 handaxes taken from the Marshall database (Marshall *et al*, 2002) which represents the complete assemblage.

Summary: The handaxes from Bowman's Lodge, Dartford were discovered *in situ* but are of no confirmed date. This means that they have little chronological or environmental value, but can be used to compare with other handaxes.

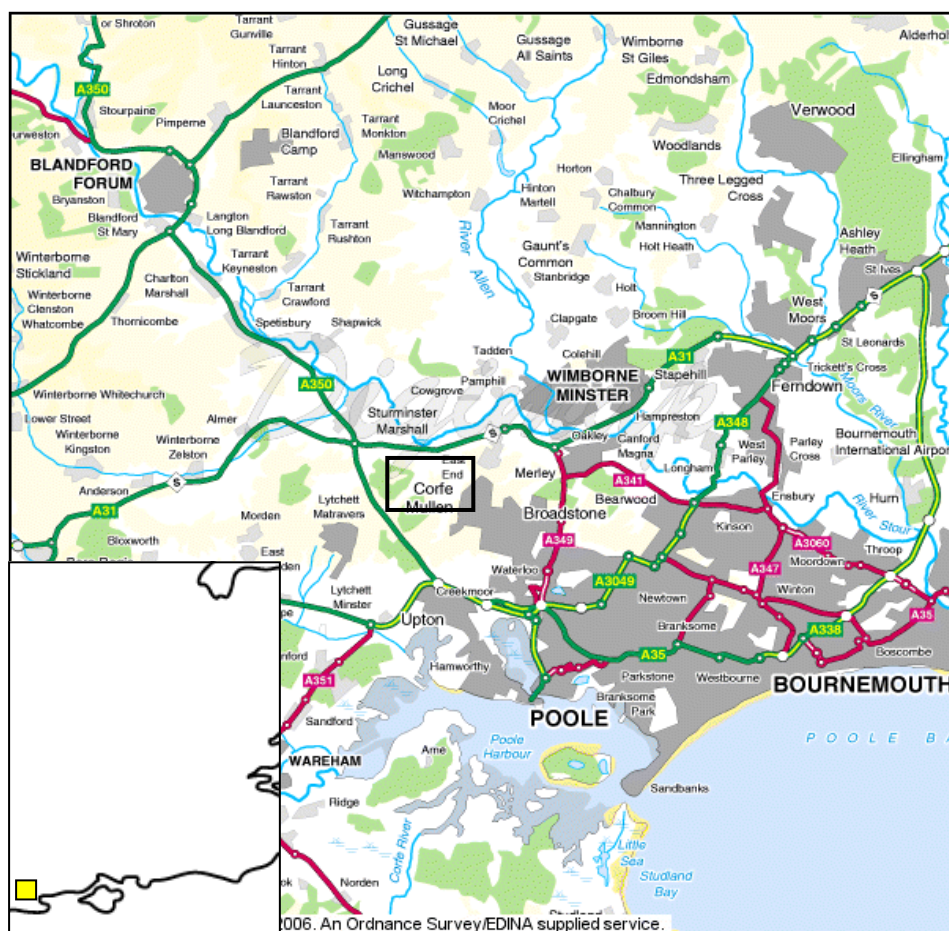
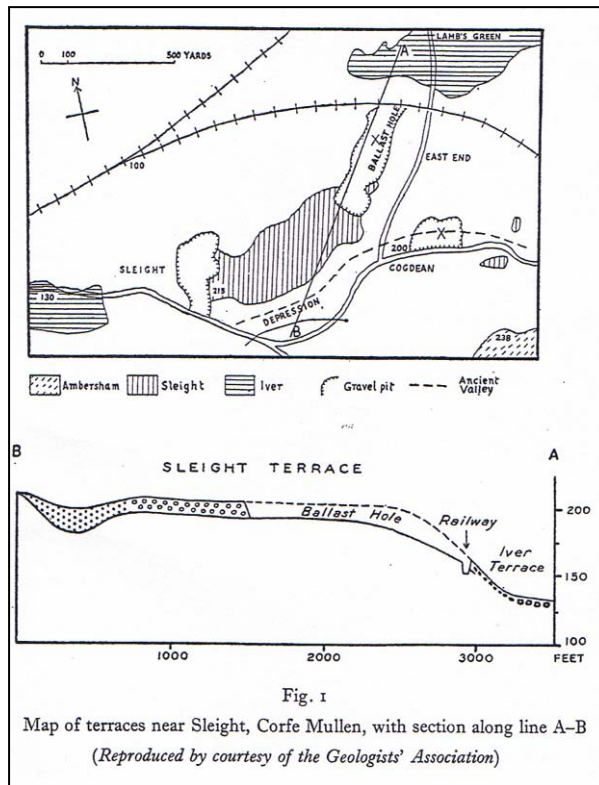


Figure 4. 52 - Corfe Mullen and surrounding area. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: The site of Corfe Mullen is located near Bournemouth, Dorset. The handaxes from gravel pits in the area were collected by Calkin and Green (1949) between 1920 and 1950.

Geological and Stratigraphic Context: The deposits at Corfe Mullen relate to the terraces of the extinct Solent River drainage system, particularly the area in which the modern day Stour runs its course. Apart from the more recent deposits (MIS 5 and 7), none of the 14 terraces of the river system are datable, leaving the archaeological sites within attributable to either an Lower or Middle Palaeolithic label, depending on position within the terrace system. The site is most likely to date

to MIS 11 or 13 as a result of the relative height of the deposits within the terrace (Bridgland, in Wenban-Smith and Hosfield, 2001) The confluence of the Stour and



the Solent Rivers, occurring in Terrace 10, created a 150ft bluff deposit which the artefact deposit at Corfe Mullen predate. Wymer (1999) is tempted to see this deposit as relating to the Anglian glaciation (MIS 12) which would place the Corfe Mullen handaxes in the Cromerian period (MIS 13) but this cannot be confirmed.

Figure 4. 53 - Map of the Ballast and Cogdean Pits (Calkin and Green, 1949, 22).

Lithic Assemblage Potential and Rationale: The assemblage is included in this study as the data is available in the Marshall database (Marshall *et al*, 2002). It was also used by Roe (1968) in his comparison of British handaxe assemblages (45 handaxes) and fell into Group VII – Ovates - Less Pointed. As it is of dubious date, it will purely be used as a non-chronological comparator for the other handaxes in the study to lend weight or dispute observations.

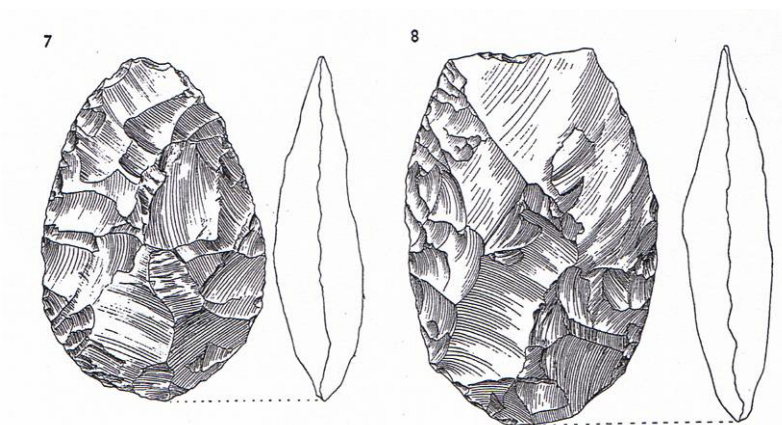


Figure 4. 54 - Two Corfe Mullen handaxes (Page 26 of Calkin and Green, 1949).

Data Collection: The assemblage consists of 138 handaxes from the Marshall database (Marshall *et al*, 2002).

Summary: The handaxes from Corfe Mullen lack a defined stratigraphic framework and a suite of environmental indicators. They are useful primarily as a comparative assemblage, comparing one handaxe to another regardless of context or age.

4.6.5 CADDINGTON, NR LUTON, BEDFORDSHIRE (TL 065 195)

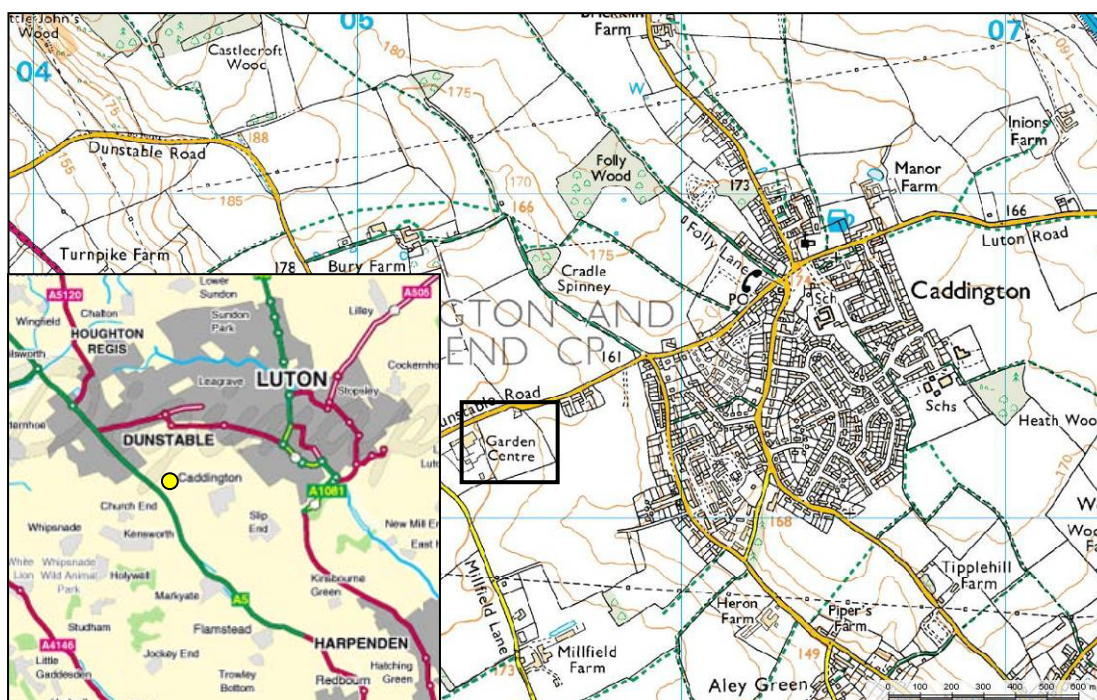


Figure 4. 55 - Map showing Caddington and surrounding area, with excavated area shown. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: The site of Caddington is situated in the Chilterns area on the Hertfordshire-Bedfordshire border. In the latter part of the 19th Century, Worthington G. Smith, an illustrator and antiquary, visited the many gravel extraction pits near Caddington and collected numerous flint artefacts from a ‘Palaeolithic Floor’ (Layer G – in Figure 3.59, below) (Smith, 1894; 1916) . The dating of the site can only be capped at the older end of the stratigraphy by the presence of possible Anglian loess deposits. Subsequent re-excavation near the original sites and reinterpretation of the Caddington artefacts has allowed a greater understanding of the site (Sampson, 1978). Handaxes with conjoining flakes and several near identical pieces (Bradley and Sampson, in Sampson, 1978) suggest the contemporaneity of the assemblage.

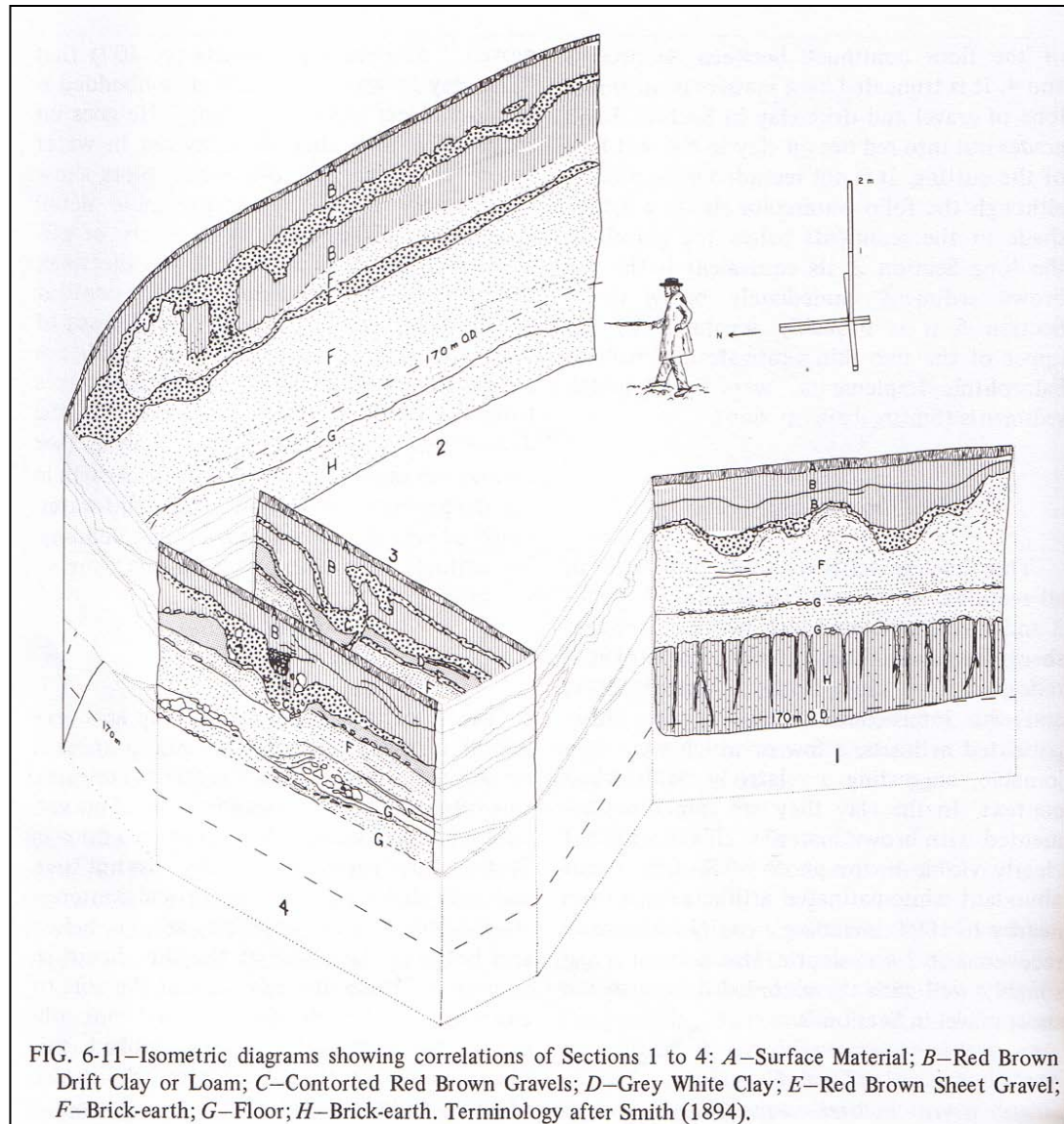


Figure 4. 56 - Stratigraphic diagram showing the sequence at several areas in the Cottages Site (Taken from Sampson *et al* , 1978, 76).

Geological and Stratigraphic Context: The Chilterns exhibit a complicated mix of deposits, with chalk uplands, brickearth, clay with flints and loessic deposits (Sampson, 1987). The deposition of the artefact-containing sediments was believed by Smith (1894) to represent a series of ‘Palaeolithic Floors’ representing discrete episodes of activity. Later work on the geology of the area concluded that the artefact-bearing ‘brickearth’ sediments in fact represented discrete pockets of sediment that infilled sink holes caused by water-erosion of the chalk bedrock. The sediment is likely to have infilled in a low-energy environment, precipitated by

warm, wet weather (Catt, in Sampson, 1978). The sporadic and indeterminable nature of these infilling events makes dating unlikely (White, 1997).

Environment, Flora and Fauna: Given the nature of the sediments, it is entirely possible that the sink holes may have presented as lakes in interglacial periods and acted as a draw to hominin populations (Sampson, 1978). Pollen indicates a grassland environment in the vicinity of a lake or marshland. Oak-dominated forest is also represented. Food-bearing species such as juniper, raspberry and hazelnut indicate a large number of plant-based resources locally. Faunal remains are lacking (Sampson, 1978).



Figure 4. 57- Example of a Caddington handaxe. Photo: KE.

Lithic Assemblage Potential and Rationale: The rationale for the use of the Caddington handaxes in this study, despite their lack of dating coherence, is threefold. Firstly, the handaxes were used by both Roe (1968) and White (1995) in their studies of British handaxe shape, fitting into Roe's Group VII – Ovates – Less Pointed which means the results of the present analysis can be compared with the

findings of both authors. Secondly, the discovery of conjoinable artefacts and similar styles of handaxe suggest that the assemblage is a good choice for looking at inter-assemblage variability. Thirdly, a relatively recent excavation and the subsequent publication of the results (Sampson, 1978) provides a substantial amount of supplementary data to complement the artefacts themselves.

Data Collection: The data set for Caddington consists of 30 handaxes, measured by hand from various sites around Caddington, that are part of the Smith Collection in Franks House, at the British Museum Stores. The handaxes were measured by hand.

Summary: The handaxes from Caddington were collected and excavated at the turn of the 20th Century, with careful recovery and recording (White, 1997; Smith, 1916). Although the date of the artefacts cannot be narrowed down to less than 3 possible interglacials (MIS 7, 9 and 11), this does not preclude their inclusion in the study. This is because there is evidence to suggest that the assemblage may have retained some level of integrity and there is a good body of work concerning the geology and environmental data.

4.6.6 BERINSFIELD, OXFORD, OXFORDSHIRE (SU 583 960)

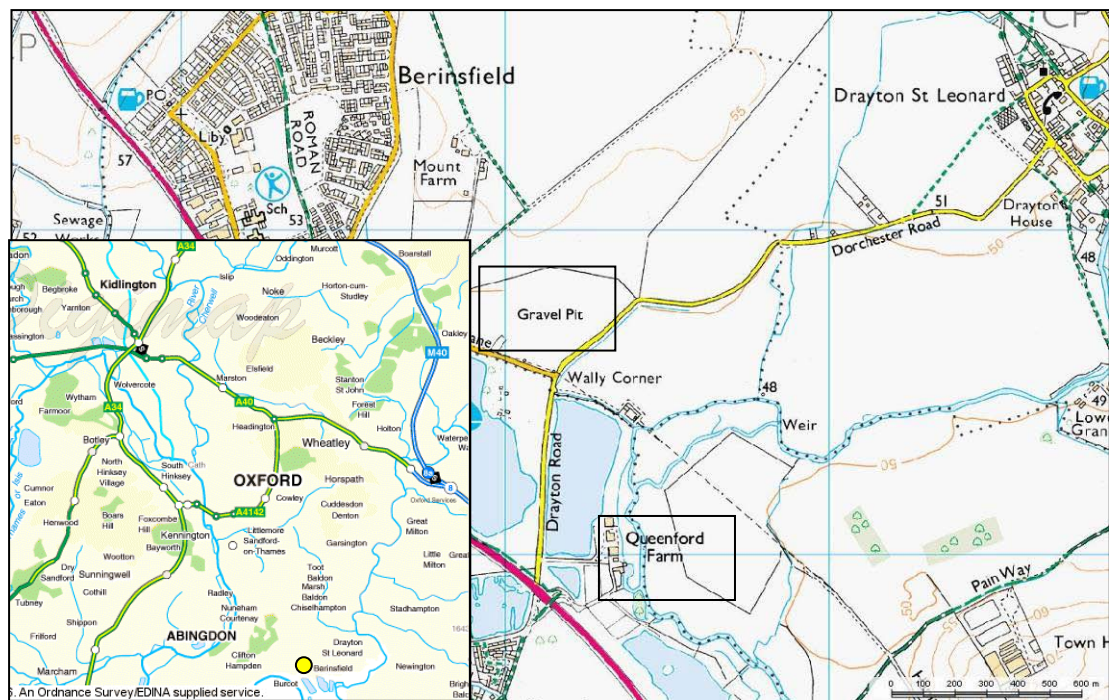


Figure 4. 58 - Map of Berinsfield and surrounding area. The two gravel pits from which the artefacts were recovered are marked with a black box. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: Berinsfield, situated to the south east of Oxford, is of uncertain date and is considered by Tyldesley (1987) to be a palimpsest accumulation of many different periods of occupation. The artefact assemblage that was recovered from two gravel extraction pits just south of Berinsfield village, represents a collection of finds recovered from the gravel processing plant by MacRae (1982).

Geological and Stratigraphic Context: As the finds were not recovered *in situ*, it is not possible to give any certainty to their stratigraphic position. Several authors (MacRae, Roe and Winterbourne in MacRae, 1982) independently observed that the artefacts were deposited underneath the main body of gravel and became incorporated into its lower layers. As there is no rudimentary stratigraphic diagram presented by any author, it is difficult to draw any conclusions as to overall position

within the Upper Thames sequence. Berinsfield is located on the cretaceous clay/sand deposits of the Chilterns, distinct from the clay deposits of the Cotswolds on which Stanton Harcourt is found (Scott and Buckingham, 2001). The deposits at Berinsfield are likely to be contemporary with those at Stanton Harcourt (Lee, 2001), however direct comparison is difficult due to the lack of a similar depositional history. What can be said is that the artefacts at both sites were deposited at the base of a gravel deposit in the Summertown-Radley Terrace. This makes them automatically younger than those at Wolvercote (MIS 9). At Stanton Harcourt, the channel gives a better age estimate for the artefacts as its fauna can be dated to MIS 7, with the artefacts being deposited in late MIS 7/early MIS 6 (Scott and Buckingham, 2001). The most accurate age estimate for Berinsfield therefore, is late MIS 8 or MIS 7.

Environment, Flora and Fauna: There are no recovered faunal and floral remains from Berinsfield.



Figure 4. 59-
Example of a
Berinsfield
handaxe
Photo: KE.

Lithic Assemblage Potential and Rationale: The lithic assemblage is the redeeming feature of the Berinsfield site. Handaxes are abundant, made from both

quartzite and flint, with one handaxe that mirrors those of Wolvercote. Although the site cannot be relied upon to provide either a certain date or an environmental context it is useful for comparison with Wolvercote and Stanton Harcourt with relation to raw material usage. It is the closest site of the three to the nearest posited source of flint raw material (MacRae, 1988) and it will be interesting to see what the impact of this is on the handaxes.

Data Collection: The dataset consists of 23 handaxes, four of which are quartzite, all recorded by hand.

Summary: The artefacts at Berinsfield are of use primarily as individual handaxes. They cannot be comprehensively demonstrated to come from a particular period or even form a complete assemblage (Lee, 2001). The value of this assemblage is in comparison with others from the same geographical area, examining the impact of differing raw material availability on handaxe manufacture.

The Middle Palaeolithic (MP) in this instance encompasses the timescale from 180,000 to 118,000 BP. The whole of this period is devoid of human presence. As previously outlined, the breach of the landbridge in MIS 12 left Britain prone to a fluctuating status between island and peninsula. This change could occur with a rise in sea level and it is suggested that the complete absence of human occupation in MIS 5e was due to a rapid rise in sea levels that literally left hominins and animals stranded on the continent (White and Schreve, 2000). MIS 5e in North-Western Europe is referred to as the Eemian (Gibbard and Kolfschoten, 2004).

4.7

LATE MIDDLE PALAEOLITHIC

The Late Middle Palaeolithic (LMP) is used in this study to encompass all of the Mousterian sites discussed below, and covers the timescale from 80,000 to 40,000 BP. The technological suite expands, with the Mousterian technocomplex subsuming Levallois technology, providing a wide-ranging toolkit with many facets and several distinct technological signatures (Bordes, 1961). The technological groupings of the Mousterian are discussed elsewhere. The populations encountered in this period are distinctively Neanderthal and the majority of Mousterian assemblages represent the variant Mousterian of Acheulean Tradition (MTA), incorporating elements of handaxe and Levallois technology alongside scrapers and denticulates. The *bout coupé* handaxe is a peculiarly British expression of the Mousterian in Britain (White and Jacobi, 2002).

4.7.1 MIS 4 – THE EARLY DEVENSIAN AND MIS 3 – THE MIDDLE DEVENSIAN

There is a wealth of climatic information for the Devensian period due to the fact that it has a much higher resolution of data than the preceding stages. The Devensian is divided into three substages by Jones and Keen (1993), Early (115-50,000 BP), Middle (50-26,000 BP) and Late (26-10,000 BP). More conventionally, the Devensian can be correlated with MIS 2 (28-12,000 BP), MIS 3 (60-28,000 BP) and MIS 4 (74-60,000 BP) (van Andel and Davies, 2003). MIS 2 and MIS 4 are defined as cold stages with a warmer period (MIS 3) sandwiched in-between. The full climatic series for the last interglacial/glacial in Europe stands as follows:

Climate Phase	Date	Marine Isotope Stage
1. Early Glacial Warm Phase	85-74	5a
2. Transitional Stage	74-66	4
3. First Glacial Maximum	66-59	
4. Stable Warm Phase	59-44	3
5. Transitional Phase	44-37	
6. Early Cold Phase	37-27	
7. Last Glacial Maximum	27-16	2

Table 4. 4 – Devensian climatic series. Adapted from Table 4.3 (Van Andel and Davies, 2003, 33).

The division in North-Western Europe is slightly different but MISs 4-2 are referred to as the Weichselian (Gibbard and Kolfshoten, 2004). Lowe and Walker (1997) focus upon MISs 2-4 as part of a study of the last interglacial/glacial cycle (130k-10k). They define MISs 2 and 4 as '*isotopically heavy*' (Lowe and Walker, 1997, 334) with a high volume of ice (especially MIS 2) and a reduction in sea level of between -75m and -120m OD. MIS 3 weighs in as '*isotopically light*' (Lowe and Walker, 1997, 334) and, for comparison, has a sea level of -50m OD. This division does not incorporate all the differences in climate within the period: Those areas not affected by ice would have been dominated by steppic and tundra type environments,

outlined in more detail below. Lowe and Walker (1997) describe this period as undergoing a '*climatic regime of arctic severity*' (Lowe and Walker, 1997, 336) with average temperatures of -5 to -10 °C, reaching lows of -25 °C in winter.

4.7.2 LYNFORD, THETFORD, NORFOLK (TL 824 948)

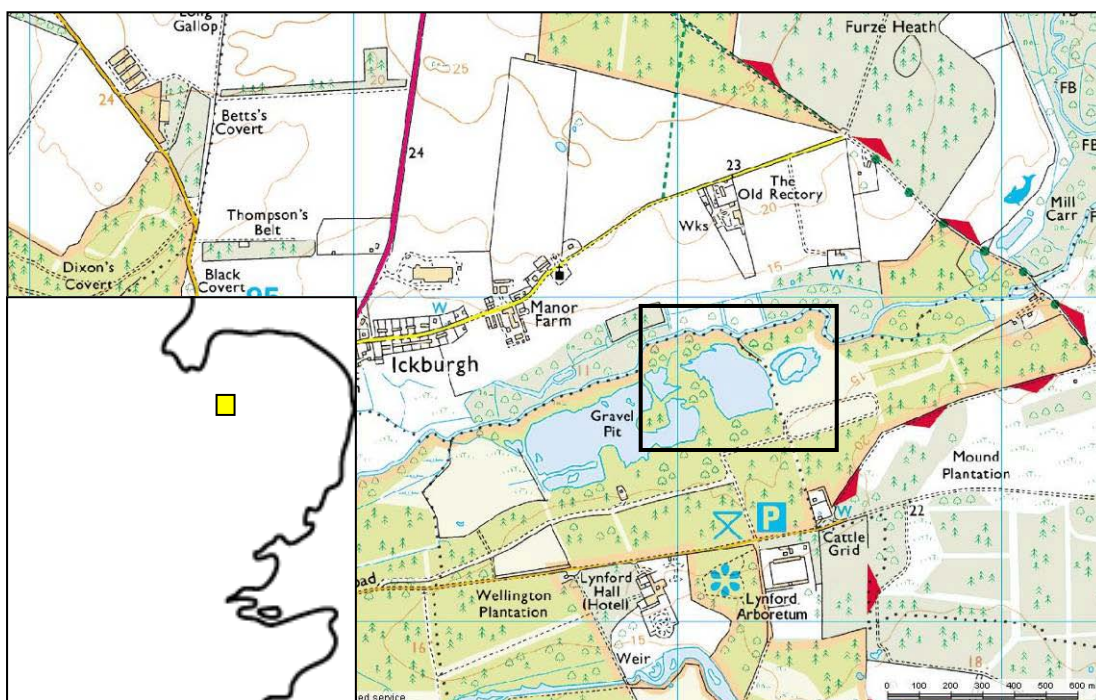


Figure 4. 60- Map of Lynford and surrounding area. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: Marine Isotope Stage 4 is the approximate date for Lynford, a Neanderthal site in Norfolk. The main artefact bearing horizon at Lynford is dated to approximately 64-67,000 BP by OSL which situates the handaxe-based assemblage as one of the earliest known *bout coupé* find spots in Britain (Boismier, 2003). The lithic assemblage includes over 40 handaxes of various sizes, and an assortment of other tools and debitage. Detailed palaeoenvironmental study has taken place, together with the assessment of the substantial faunal assemblage (Boismier *et al*, unpublished).

Geological and Stratigraphic Context: The artefacts from Lynford were dispersed through several levels, however the majority of the finds came from one stratigraphic layer and its contacts with the layers above and below. This stratigraphic unit (20003) represents the infill of a palaeochannel, thought to be a cut-off meander

(Oxbow lake) from an ancient river (see Figure 3.68, below). Artefacts were retouched and discarded on the margins of the channel then incorporated into the channel fill as part of debris flows that slumped into the water, and buried as the channel silted up (Boismier *et al*, 2003; Boismier, *pers. comm.*).

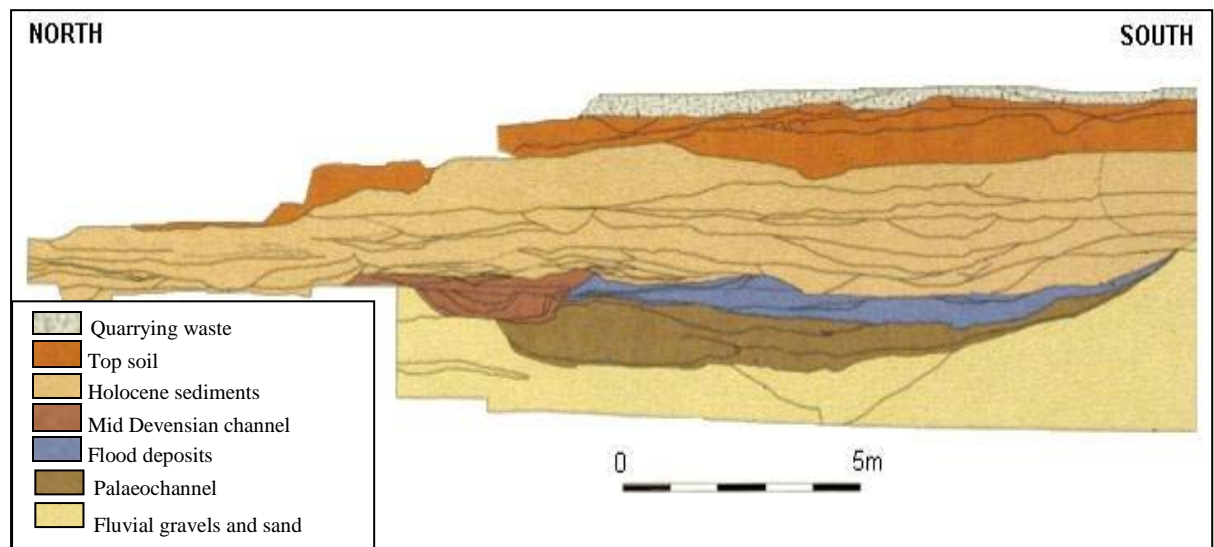


Figure 4. 61- One of the stratigraphic sequences at Lynford. The palaeochannel deposits (20003) are represented in dark brown. Reproduced with permission from Bill Boismier.

Environment, Flora and Fauna: The Lynford fauna is dominated by woolly mammoth remains (91%, Schreve, 2006) but elements of reindeer, woolly rhinoceros, reindeer, bison, fox and bear were also represented (Boismier *et al*, 2003). Evidence for human modification of bone is limited to bones broken to extract marrow (Schreve, 2006) and there is no direct evidence of mammoth hunting (Smith, *pers comm.*). The profile of the mammoth remains, mostly male with varying age ranges, together with the weathering on the bones suggests an attritional profile of bone accumulation over time rather than a catastrophic event (Schreve, 2006). The floral information is provided by pollen, mollusc, plant macrofossil and insect analysis. These indicate a shallow, slow-moving body of water with marshy vegetation surrounding it. The abundance of dung and carrion beetles suggest the presence of living and dead animals. The wider environment consisted of open

grassland with small areas of trees. The climatic regime suggested by the floral and faunal data is a range between 13°C and -10°C. A mammoth-steppic (Guthrie, 1982) cool tundra environment is suggested.

Lithic Assemblage Potential and Rationale: The handaxes at Lynford form part of a wider set of tool types in a Mousterian toolkit. There is a complete lack of Levallois debitage, which is unusual for MTA A assemblages which typically retain



a small element of Levallois technology (Coulson, 1990). The raw material is locally sourced, with the exception of one handaxe made from Lincolnshire banded flint.

Figure 4. 62 - A Lynford unifacial implement. Photo: KE.

Primary stages of manufacture are underrepresented, with shaping and recycling reduction evident on a number of pieces (Boismier *et al*, 2003). The lithic assemblage orientation data corresponds with that from the faunal data, suggesting accumulation in the channel through slumping sediments from the channel margins (Smith, *pers. comm.*)



Figure 4. 63: Example of a typical Lynford handaxe. Photo: KE.

Lynford and Boxgrove perhaps provide the best opportunities to assess the environmental context of tool-production in the Lower and Middle Palaeolithic. The handaxes from Lynford indicate an interesting mix of *debitage* and *façonnage* types of manufacture – as the Lynford handaxes are often made on flake blanks instead of from a core roughout. The observation that the handaxes and scrapers form a continuum of production (White, in Boismier, *unpublished*) appears to typify the notion of fluid and changeable tool forms in the Palaeolithic (Boeda, 1995).

Data Collection: The dataset consists of 36 flint handaxes, together with metrical data for the remainder of the lithic assemblage, recorded personally with the permission of Dr. Boismier.

Summary: The assemblage from Lynford is of importance to the study of handaxes as it marks the return of handaxe technology after a hiatus imposed by the widespread adoption of Levallois technology. The conditions surrounding the return of handaxes and the possible reasons why will be explored in a later chapter. The assemblage is an *in situ* palimpsest accumulation of hominin activity with a good faunal and environmental record.

4.7.3 OLDBURY, IGHTHAM, KENT (TQ 584 568)

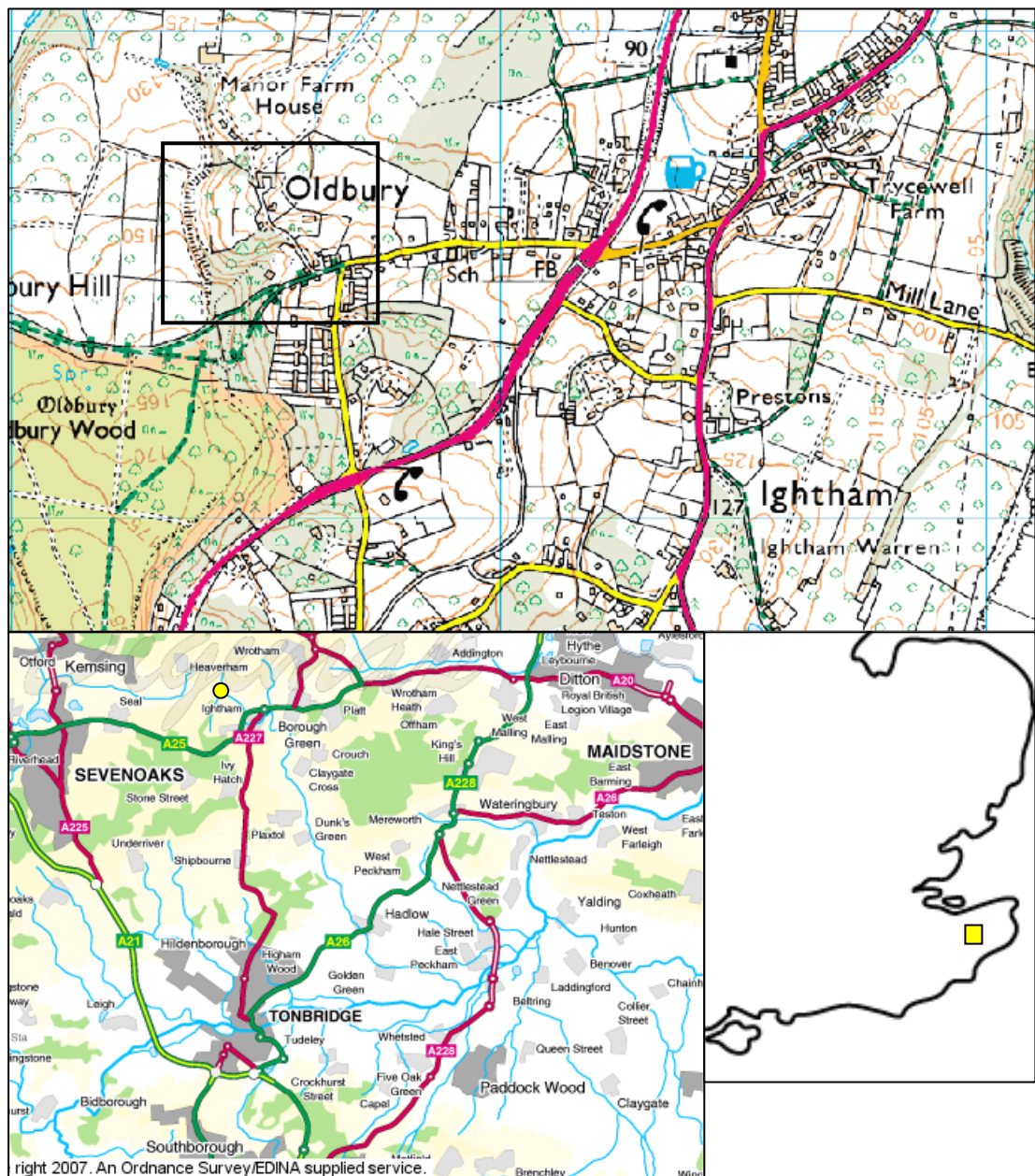


Figure 4.64: Map of Oldbury and surrounding area. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: Excavations at Oldbury first took place in the late C19th by Mr B.Harrison, village grocer and Palaeolithic enthusiast (Cook and Jacobi, 1998a). Harrison's excavations (Harrison, 1891) found few handaxes or tools that could be characterised as Mousterian, although earlier surface finds and investigations had garnered him several implements of 'Rockshelter' type, i.e. Mousterian. It is not clear if the site at Oldbury was ever a rockshelter: Wymer (1999) speculates that the

weathering of stone in the area had destroyed any vestiges of a rockshelter structure. Excavations were then undertaken at Oldbury in 1965 (Collins and Collins, 1970) and uncovered a reasonable collection of flakes and tools, with four complete handaxes. The full assemblage stored at the British Museum has also been recently reassessed (Cook and Jacobi, 1998a). Before the discovery at Lynford (above), Oldbury was the most prolific Mousterian site in Britain, with at least 45 handaxes, including 5 bout coupé type (Wymer, 1999).

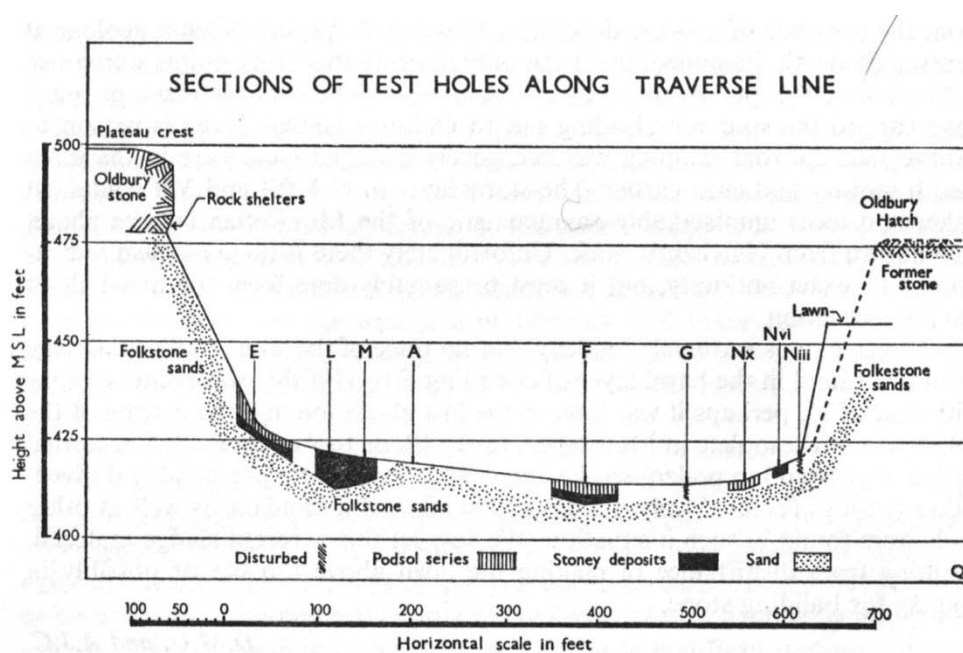


Figure 4. 65: Diagram of test pits dug by Collins and Collins (1970, 157).

Geological and Stratigraphic Context: The 1965 excavations provide the best indications of stratigraphy and geological deposits. The bedrock in the area was lower Greensand, capped by a variable brown deposit, with frost-fractured inclusions. This was capped by a hard pan, leached sand and topped by a leaf-mould humus. Collins and Collins (1970) see the basal stony deposit as the infilling of the freshly cut valley with rock shatter covered by silts and sand washing down the sides of the valley, with some soil formation. The only artefacts found during the excavation came from the stony layer in one group of test pits, and is not thought to

be contemporary to the stony layer in the other trenches where no artefacts were found. Unfortunately there is no geological or stratigraphic means for dating the site at Oldbury.

Environment, Flora and Fauna: There is no record in any of the publications of any faunal or environmental remains found in association with the lithic remains.

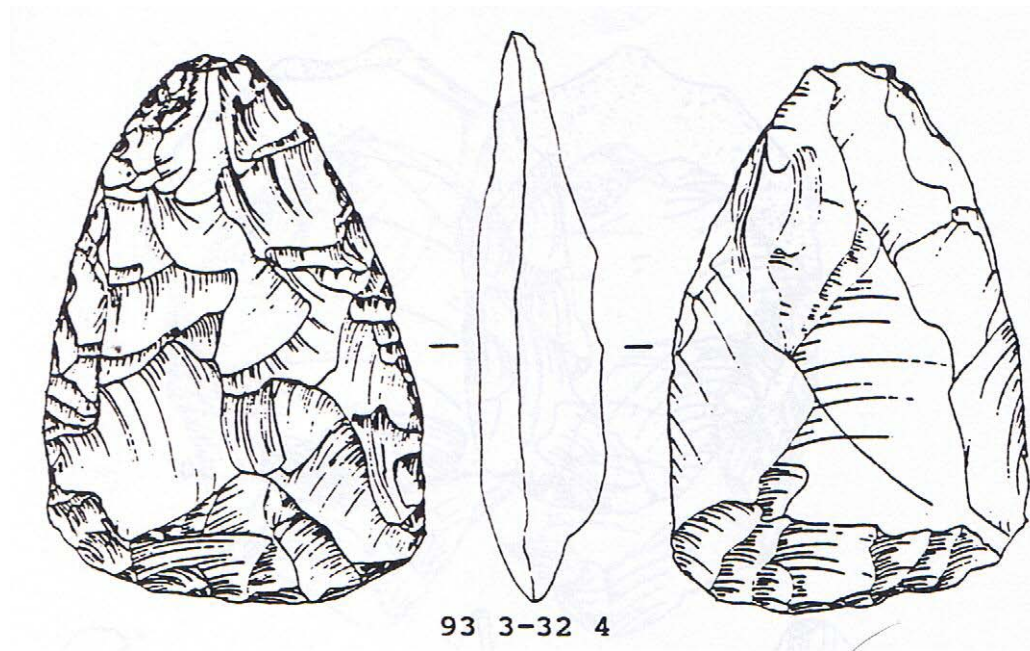


Figure 4.66: Example flint handaxe from Oldbury. Illustrated in Coulson (1990, 340).

Lithic Assemblage Potential and Rationale: The lithics recovered during the 1965 excavation were easily matched to those of Harrison's 1890 excavation (Harrison, 1891) by the bluish patina on the artefacts. Collins and Collins (1970) record 39 handaxes found by Harrison and supplement 4 of their own. Not all of these handaxes are available for study in the British Museum. Coulson (1990) lists 3 blades, 17 flake tools and 12 handaxes contained in the Harrison Collection at the British Museum, supplemented by the Collins collection. This is confirmed in the recent reevaluation by Cook and Jacobi (1998a) who also identified a substantial element of discoidal core reduction in the assemblage. Coulson (1990) defines the

assemblage as non-laminar and non-Levallois, and there is no source of flint locally, so the raw material must have been imported. The presence of handaxe reduction flakes suggests that handaxes were being reworked on the site (Cook and Jacobi, 1998a). Although contextually the assemblage appears to be a mixture of secondary and primary context remnants from an undated context, the proliferation of handaxes from this site makes it an important component of any study of the British Mousterian. Authors agree that it is possible to attribute the Oldbury material to the Mousterian (MIS 3-4) on a typological basis (Collins and Collins, 1970; Cook and Jacobi, 1998a; Coulson, 1990; Roe, 1968; White and Jacobi, 2002; Wymer, 1999).

Data Collection: The dataset consists of 13 handaxes (12 flint, 1 chert) measured by hand at the British Museum.

Summary: The site of Oldbury, Kent, is an important site for assessing the Mousterian in Britain. A possible rockshelter locality, the site is limited in terms of stratigraphic context and faunal association. Although it can only be dated typologically, it is unlikely to be from a non-Mousterian context, and as such can be used to compare bifacial manufacturing methods with other Mousterian sites, and as a contrast to the Acheulean sites. Whilst the whole assemblage is not accessible, the remaining handaxes still make it one of the larger Mousterian assemblages available for study.

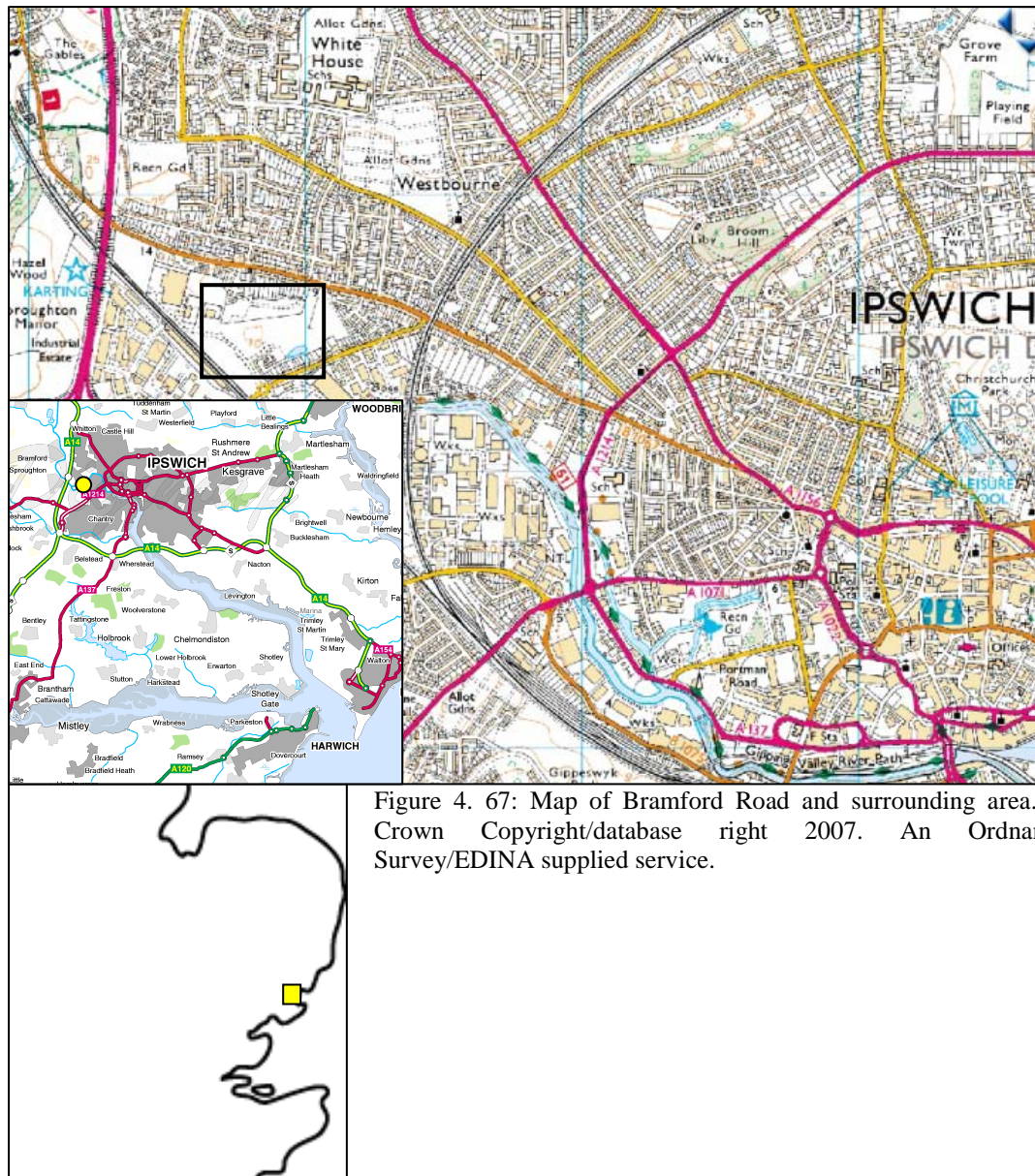


Figure 4. 67: Map of Bramford Road and surrounding area. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: The artefacts from Bramford Road Pit, Ipswich were recovered in a less than ideal fashion, from the suction pumps employed for keeping the pit dry. A large collection containing numerous flat-buffed cordiforms and sub-triangular handaxes represents one of the largest collections of Devensian age material in Britain. Associations with stratigraphy from nearby Constantine Road allow for some stratigraphical correlation (White and Jacobi, 2002).

Geological and Stratigraphic Context: The method of extraction necessarily means that the majority of artefacts are without contextual information. However, some of the artefacts retained some remnant of the strata they were contained within, which was likened to a peaty loam above a gravel river deposit noted at Constantine Road (White and Jacobi, 2002). This could be correlated with a lower terrace of the River Gipping (Roe, 1981). Wymer (1999) believes that the associated stratigraphy at nearby sites, combined with a small number of Upper Palaeolithic finds from the same strata, is enough to be confident of a Middle Devensian age.

Environment, Flora and Fauna: A mix of cold-climate fauna was recovered from Bramford Road. Elements of mammoth, woolly rhinoceros and reindeer indicate a date within the Devensian (Moir, 1931; White and Jacobi, 2002).

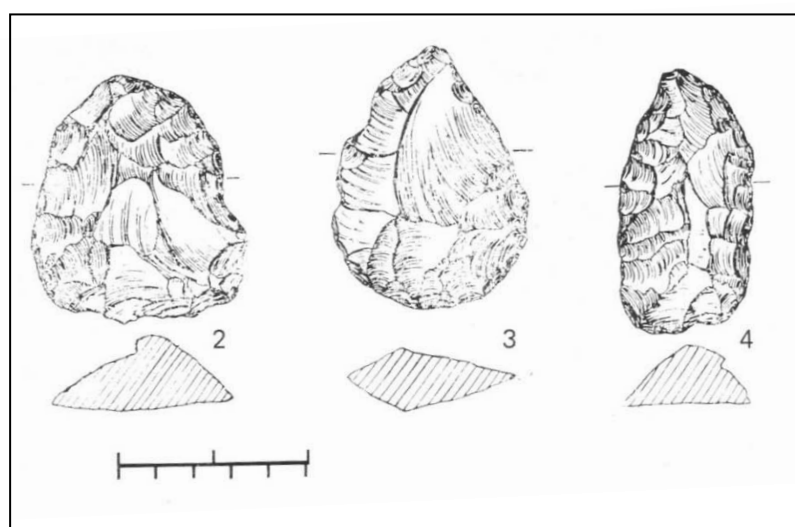


Figure 4. 68: Three Bramford Road handaxes. Illustrated in Roe (1981, 223).

Lithic Assemblage Potential and Rationale: There is a mixture of Lower, Middle and Upper Palaeolithic artefacts in the Bramford Road assemblage. Coulson (1990) notes that the condition of the artefacts was poor due to the method of collection. Whilst there is at least one ‘true’ bout coupé in the assemblage, White and Jacobi (2002) were unable to consider Bramford Road in their assessment of bout coupé

find spots due to the contextual problems, although they believed that there was almost certainly a Devensian component to the assemblage. The total assemblage contains at least 134 handaxes and a small Levallois component (Roe, 1968). The handaxes can be characterised as small, ovate and cordate forms with a strong element of sub-triangular types. Although there are clearly problems with the utilisation of the Bramford Road handaxes, the size of the assemblage and the rough attribution to the Devensian allows for some limited analysis to be undertaken.

Data Collection: The dataset consists of 63 handaxes measured by hand from the Ipswich Museum collection.

Summary: The site at Bramford Road is unconventional in many respects, not least the method of collection which has had an effect on the condition of the handaxes. The association of stratigraphic sequences from Bramford Road with other, better documented sites in the area lends some support to a Devensian age, as does a representative faunal suite. The large number of handaxes attributable to the site makes it one of the largest potential datasets in the British Mousterian.

4.7.5 KENT'S CAVERN, TORQUAY, DEVON (SX 934 641)



Figure 4. 69: Map of Kent's Cavern and surrounding area. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: The cave complex at Kent's Cavern has a long history of archaeological and geological investigation. MacEnery's excavations in the mid-late 1820s, revealed associated lithics and faunal remains that are thought to be some of the earliest prehistoric discoveries (Roe, 1981) unearthed during a period when the antiquity of humanity was not yet fully accepted. The most significant excavations were conducted by Pengelly (1865) who uncovered a sequence of lithics dating from Lower to Upper Palaeolithic. Over 1000 stone artefacts were recovered, although only a small sample of these is still available for study (Roe, 1981). Unfortunately, the majority of deposits in the cave were removed by Pengelly's excavations, and it

has been left to others (Rogers, 1954; Campbell and Sampson, 1971; Coulson, 1990) to reconstruct much of the stratigraphy from the notes left by Pengelly.

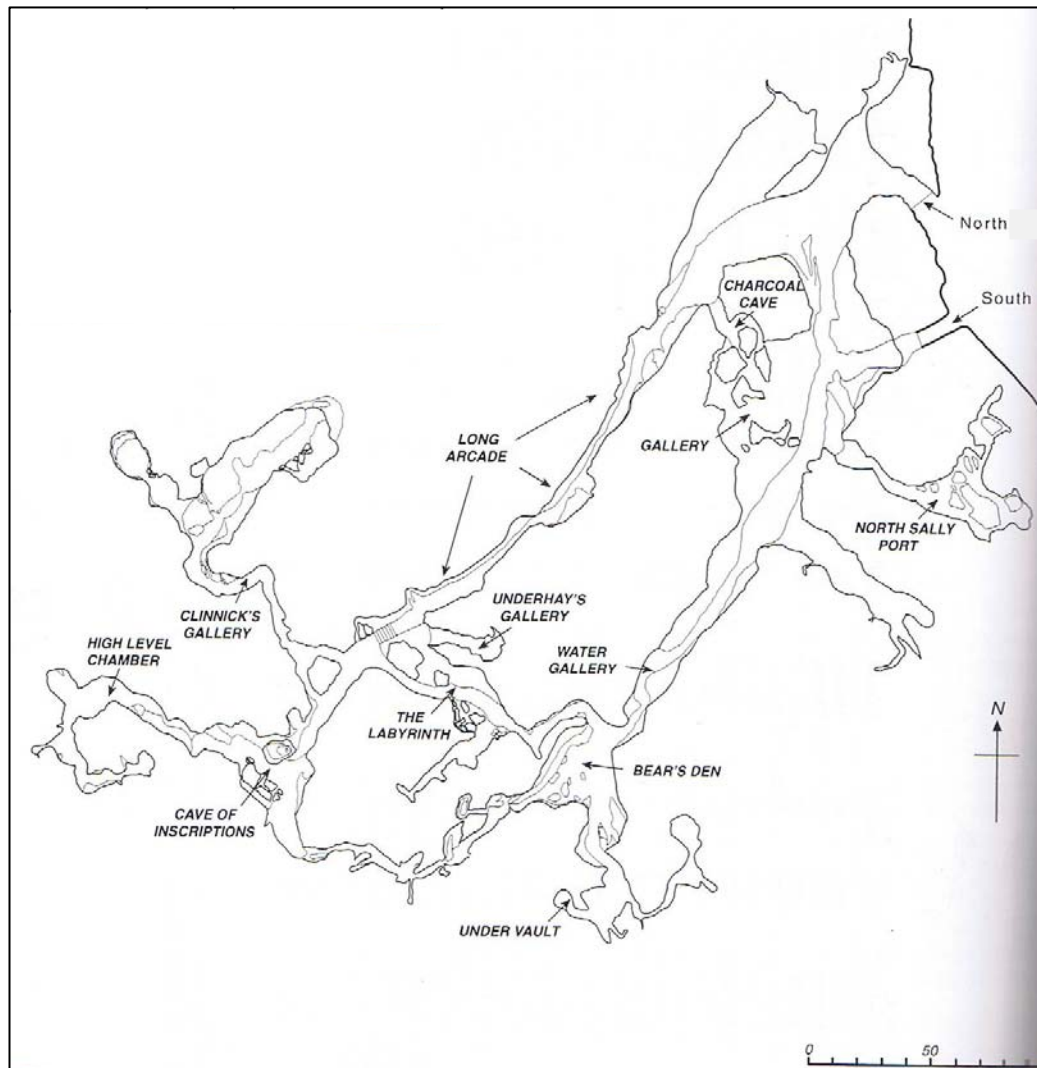


Figure 4. 70: Plan of Kent's Cavern. Reproduced from Cook and Jacobi (1998b, 80).

Geological and Stratigraphic Context: Campbell and Sampson (1971) identified four artefact-bearing horizons within the cave sequence. The earliest, an Acheulean industry contained within a Breccia deposit has been recently reexamined by Cook and Jacobi (1998b). Stalagmite flows then separate the Breccia deposit from a higher Mousterian deposit, the artefacts from which are the consideration of this study. The artefacts are found within a layer of Loamy Cave Earth, which is topped by Upper Palaeolithic artefacts. Mesolithic and Neolithic finds cap the sequence.

Environment, Flora and Fauna: A good faunal assemblage was recorded in association with the Mousterian artefacts from Kent's Cavern. The presence of a Devensian faunal suite containing mammoth, reindeer, bear and woolly rhinoceros (Roe, 1981) and hyaena are representative of a Pin Hole mammalian assemblage type. Radiometric dating provides a *terminus ante quem* date of 34,000 BP, with U-Series and ESR dating, combined with biostratigraphical information, suggesting that deposition of the Mousterian strata began after 60,000 BP (White and Jacobi, 2002).

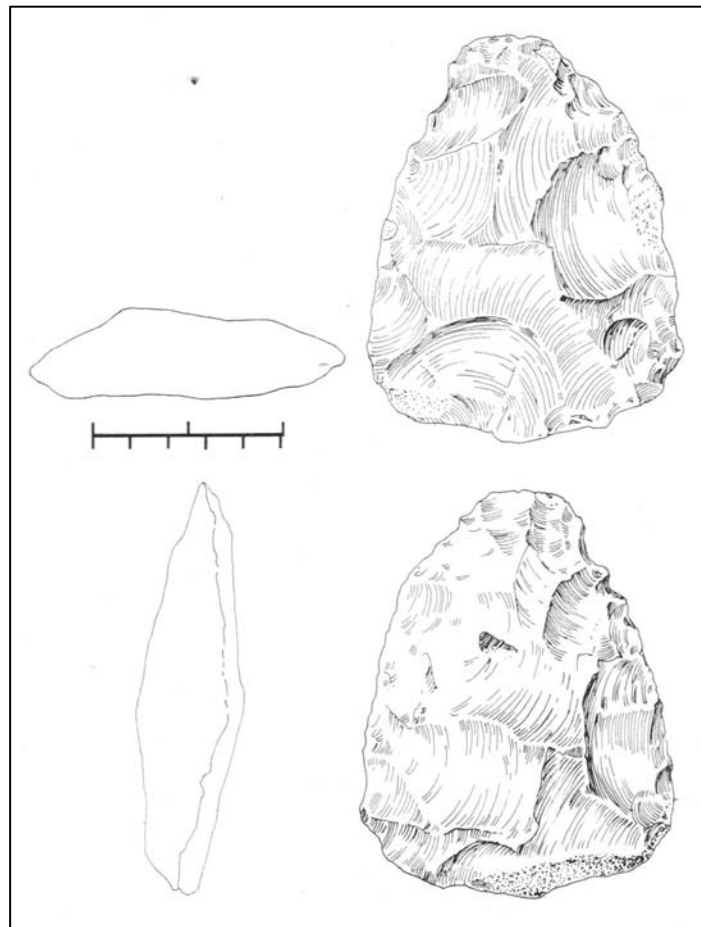


Figure 4. 71: Bout coupé handaxe from Kent's Cavern. Reproduced from Roe (1981, 242). Scale 5cm.

Lithic Assemblage Potential and Rationale: Of the many pieces recorded, only 45 remain that are securely provenanced to the Mousterian layer. These are supplemented by other pieces of Mousterian derivation which were not as reliably provenanced. The assemblage includes 8 handaxes, four of which are considered to

be 'true' bout coupés as defined by Tyldesley (1987). Other tools included side and end scrapers, burins and awls. There was no Levallois material. The secure dating of the Mousterian strata, plus a good number of handaxes available for study makes Kent's Cavern an ideal site for inclusion in the study.

Data Collection: The sample consists of 4 flint handaxes measured by hand at the Torquay Museum and the Natural History Museum.

Summary: The site of Kent's Cavern, excavated extensively in the C19th, is a rare find in this context. It has been well recorded and contains a representative faunal suite. Dating techniques allow the artefacts to be placed within a secure Mousterian/Devensian context.

4.7.6 COYGAN CAVE, CARMARTHENSHIRE, WALES (SN 284 091)

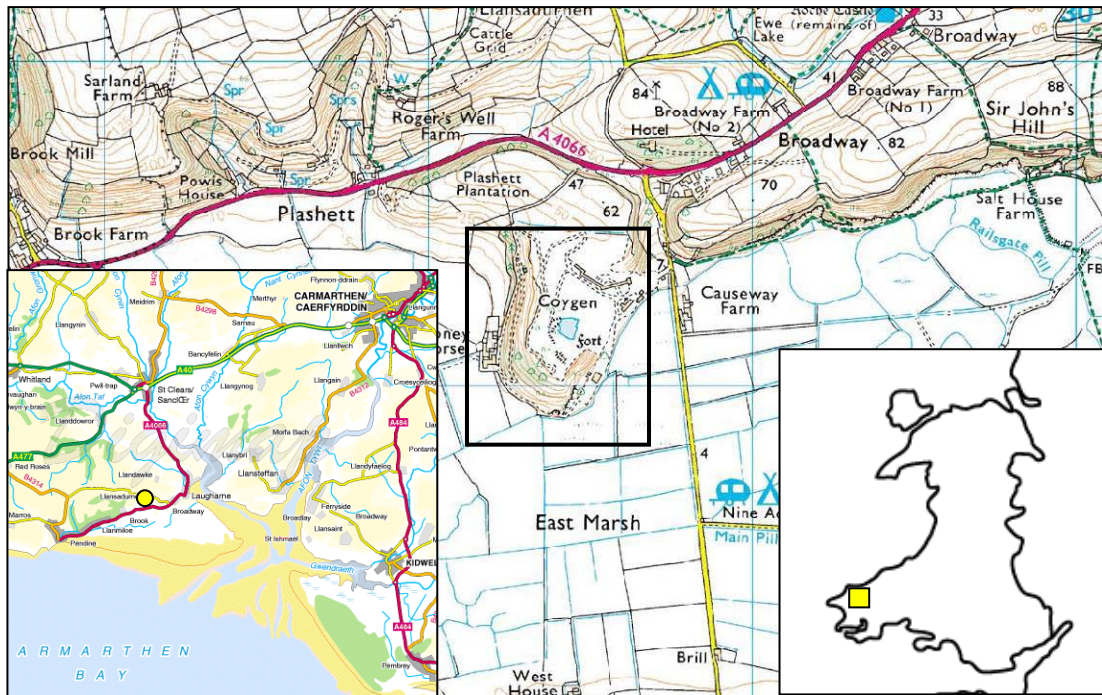


Figure 4. 72- Map of Coygan Cave site and surrounding area. © Crown Copyright/database right 2007. An Ordnance Survey/EDINA supplied service.

Introduction: The site of Coygan Cave is situated on the south-western tip of Wales near Carmarthen Bay. Excavated several times from the mid 19th to the mid 20th Century (Hicks, 1867; Laws, 1888; Wardle, 1919; Grimes and Cowley, 1935), the site was most notably excavated under the auspices of Cambridge University in the 1960s by McBurney and Clegg. The results of this excavation were not published in detail until 1995 (Aldhouse-Green *et al*, 1995). The cave within which the artefacts were found has now been quarried out and did not yield a large assemblage of lithic artefacts during excavation. However, of the few handaxes recovered, three were of bout coupé type, representing ‘*the only certain Mousterian finds from the whole of Wales*’ (Aldhouse-Green *et al*, 1995, 37).

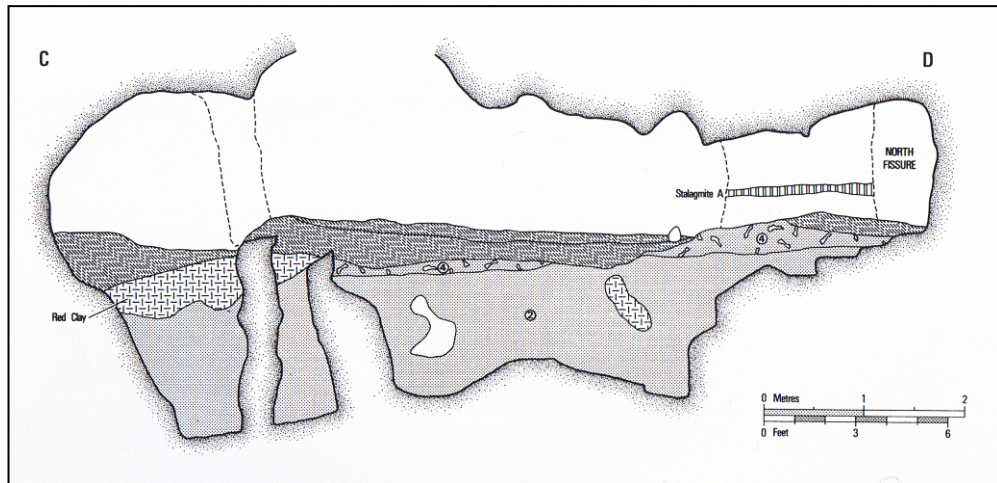


Figure 4.73 - One of the stratigraphic sequences from Coygan Cave (taken from Aldhouse-Green, *et al*, 1995, 56)

Geological and Stratigraphic Context: The main sequence of deposits in the cave was capped by a post-glacial stalagmite (A), effectively sealing the layers below. Underlying this, a layer of buff sandy-cave earth (5) was excavated containing a large assemblage of bones. This was underlain by a further stalagmite layer (B) which capped a deposit (4) consisting of a brown sandy cave-earth containing more bones and also the two handaxes found in the 1960s excavation. This was underlain by a further stalagmite deposit (C). AMS Radiocarbon dating of the archaeological horizons suggests that hominin occupation of the cave took place between 64,000 BP and 38,000 BP (Aldhouse-Green *et al*, 1995).

Environment, Flora and Fauna: There is a significant amount of faunal information provided by the excavations at Coygan Cave. The majority of the species in the cave are believed to have resulted from the accumulation of bones created by canid action, most likely by hyenas. It is thought that hominin action predates the use of the hyena occupation of the cave, though the paucity of archaeological remains suggest the human presence was brief. The faunal information is more indicative of the wider environment, than the interaction of the hominins and their surroundings.

Horse and woolly rhino dominate the assemblage and this is seen by the authors (Aldhouse-Green *et al*, 1995) to reflect the faunal suite of the time, and is not simply a representation of selective hunting by hyenas. The likelihood of bones being destroyed by gnawing is also a factor in the accumulation of the faunal assemblage. The faunal data suggests a predominantly grassland environment, similar to that described for Lynford (Aldhouse-Green *et al*, 1995).



Figure 4. 74- Photograph of the larger Coygan handaxe. Photo: KE.

Lithic Assemblage Potential and Rationale: The lithic assemblage at Coygan Cave comprises five artefacts. Of these, three are handaxes, all of which are bout coupés. It is not particularly unusual to recover a small amount of lithics, in fact, many Mousterian 'sites' only comprise ten or fewer handaxes, many only represented by a single isolated surface find (Wymer, 1999). The inclusion of the site in this study results from the need to provide comparative assemblages for Lynford, the geographical location of the site is also interesting.

Data Collection: The data collection consists of three handaxes, all measured by hand at the Cardiff Museum.

Summary: The site of Coygan Cave, whilst not providing a large assemblage of handaxes, is included in this study as a comparative site for Lynford. The handaxes are in primary context and are dated by association to within the Devensian. They also appear to be *in situ*. The large amount of faunal data, although not a product of human activity, provides good information concerning the type of environment inhabited by the Coygan hominins.

The preceding discussion has identified all the sites involved within this analysis, their potential dataset and the interesting features of the lithic assemblage, together with a justification for inclusion within this study. The following two tables summarise the information presented above:

Period	MIS	Date (k BP)	Technology	Sites	Notable Technological Features	Assemblage Size		
						H	ADS	Roe
Early Lower Palaeolithic	13 Cromerian	500-480	Acheulean	Boxgrove	Tranchet Flakes	30	153	
				Warren Hill	Acheulian		148	636
	11 Hoxnian	430-380	Acheulean	Hitchin	Twisted Ovates	25		79
				Swanscombe	Acheulian	30		159
	9 Purfleet	320-290	Acheulean	Furze Platt	Large handaxes	25		469
				Red Barns	Plano-convexity	5		
				Wolvercote	Plano-convexity	34		47
Early Middle Palaeolithic	8	290-230	Acheulean	Broom	Late Acheulian	16	253	171
	7 Aveley	230-180	Late Acheulean/ Levallois	Pontnewydd	Exotic Raw Materials	32		
				Great Pan Farm	Late Acheulian	83		44
				Stanton Harcourt	Quartzite handaxes	29		
Undated Lower Palaeolithic				Biddenham	Large handaxes	25		304
				Cuxton	Elongated handaxes	30	162	
				Caddington	Acheulian	30		35
				Corfe Mullen	Acheulian		138	45
				Bowman's Lodge	Acheulian		29	29
				Berinsfield	Quartzite handaxes	23		
Late Middle Palaeolithic	4 Early Devensian	74-60	Mousterian	Lynford	MTA handaxes and unifaces	36		
				Kents Cavern	MTA handaxes	4		
	3-4 Devensian		Mousterian	Oldbury	MTA handaxes	13		31
	3 Middle Devensian	60-28	Mousterian	Bramford Road	MTA handaxes	63		
				Coygan Cave	MTA handaxes	3		

Table 4. 5 – Summary table of sites and technology (H = hand/ ADS = Marshall database/ Roe=total recorded by Roe (1968). Numbers in bold indicate that the complete handaxe assemblage was recorded.

Site Name	Secure Dating Evidence	MIS Correlation	Faunal Assemblage	Environmental Data	Raw Material Sourcing	High % Non-flint tools	Excavated	Collected	Roe Group	White
Berinsfield					✓	✓		✓		
Biddenham				sparse			✓	✓		
Bowman's Lodge								✓	I	✓
Boxgrove	✓	✓	✓	✓	✓		✓			✓
Bramford Road		✓	✓					✓		
Broom	✓	✓		sparse	✓			✓	IV	
Caddington				✓	✓			✓	VII	✓
Corfe Mullen								✓	VII	
Coygan	✓	✓	✓	✓			✓	✓		
Cuxton			sparse		✓		✓	✓	I	
Furze Platt		✓			✓		✓	✓	I	✓
Great Pan Farm		✓						✓	VI	✓
Hitchin		✓	not associated	not associated				✓	II	✓
Kents Cavern	✓	✓	✓				✓			
Lynford	✓	✓	✓	✓	✓		✓			
Oldbury		✓			✓		✓	✓	VI	
Pontnewydd	✓	✓	✓	✓	✓	✓	✓	✓		
Red Barns		✓	sparse		✓		✓			
Stanton Harcourt		✓	✓	✓		✓		✓		
Swanscombe	✓	✓	✓	✓	✓		✓	✓	II	✓
Warren Hill		✓			✓		✓	✓	VII	
Wolvercote		✓	✓		✓	✓		✓	III	✓

Table 4. 6 – Showing the presence/absence of information about key contextual aspects.

Table 4.6 summarises the information presented above in terms of presence and absence of key data. Clearly, sites such as Corfe Mullen, Berinsfield and Bramford Road offer little in the way of contextual information, and the handaxes from these

sites should be considered solely as objects. Others, such as Boxgrove and Lynford have vast amounts of contextual information and these sites will be key for examining any environmental factors influencing manufacture. Many of the sites have been studied by other researchers – Roe (1968), White (1995), Green (1984) etc – allowing for comparison with their results and testing of their hypotheses. Below, an examination of which sites can be compared with relation to supporting or discounting the hypotheses discussed in Chapter 2 is outlined.

4.9

KEY COMPARISONS

The site summaries detailed above revealed several aspects of variability which could be examined by the selection of suitable sites for comparison. These are as follows:

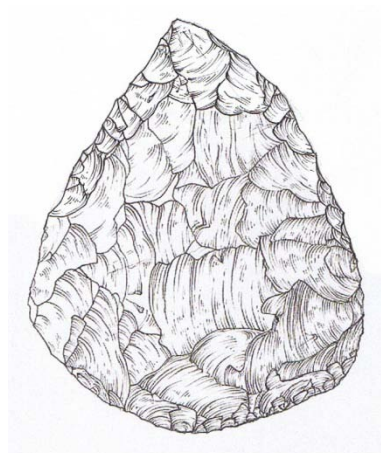
Metrical Variability: All of the sites mentioned above will be used in a comparison of metrical variability (Chapter 5), both within and between assemblages. This will be undertaken firstly by using Roe's scheme of metrical analysis, comparing the results of this analysis with those previously obtained, where possible, and then moving on to discuss the nature of handaxe variability in Britain with regards to the opposing models of White (1995) and McPherron (1995).

Modelling Variability: The sites of Berinsfield, Boxgrove, Broom, Caddington, Coygan, Cuxton, Great Pan Farm, Hitchin, Lynford, Pontnewydd, Red Barns, Stanton Harcourt, Swanscombe and Wolvercote will be used in a pilot study of a new methodology for measuring variability, outlined in Chapter 6. The pilot study will

attempt to examine variability between individual handaxes in relation to edge variability.

Raw Materials: All of the sites in the study could be examined to look at the simplistic relationship between raw material type, quality and the type of handaxes predominant in the assemblage. Chapter 5 will examine the basic tenets of the Raw Materials Hypothesis (White, 1998a) to ascertain the extent to which the collected data fits the model. The more complex level of analysing residual cortex to recreate original nodule shape and size will not be attempted as it is not easily replicated. The examination of the use of raw material types in relation to the availability of flint resources is an avenue by which to assess the role that raw material type plays in variability which was not within the primary scope of this thesis.

Cultural Explanations: All of the sites analysed can potentially be used to assess the symbolic and non-functional aspects of handaxe production and use. This discussion will be undertaken in Chapter 7, with specific reference to unusual handaxe types such as twisted ovates (Hitchin), elongated ficrons (Cuxton) and the evidence for preferential manufacture of a specific type of handaxe at Boxgrove.



CHAPTER FIVE: TESTING ROE, RAW MATERIALS AND RESHARPENING

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As outlined in Chapters 2 and 3, wide-ranging studies of handaxe-dominated assemblages in the British Palaeolithic have been attempted by other authors (c.f. Roe, 1968; Wymer, 1968; McPherron, 1995; White, 1998a) and focussing on the categorisation and explanation of variability is by no means a unique approach to the study of handaxes. However, there is still a great deal of debate surrounding the causes and explanation of bifacial variability that has not been satisfactorily addressed in previous studies. Nevertheless, through the recording and analysis of bifacial variables, it should be possible to address some of the wider debates which are currently prevalent in Palaeolithic handaxe studies. This chapter follows on from the discussion in Chapter 3 and begins with the practical application of Roe's schema of handaxe variability (Roe, 1964; 1968), using the data collected from the sites outlined in Chapter 4. This is followed by an in-depth discussion and application of McPherron's (1994; 1995; 2000) methodological approach to handaxe variability, where he concluded that resharpening was the key causal factor. The results of this analysis are then used in Chapter 6 to propose a new methodology for examining handaxe variability.

The discussion of Roe's (1968) metrical methodology in Chapter 3 concluded that there were potential pitfalls involved in using the method as a basis for positing causal factors for handaxe variability. However, it does not necessarily follow that the methodology itself is inadequate, as it may still provide some useful

classificatory information. So, on this basis, it is possible to examine each of the datasets collected during the present study with relation to Roe's groupings. To refresh, the measurements required for Roe's calculations are as follows:

Measure	Abbreviation	Description	Relevance
Length	L		The three basic measurements of size. Used in their own right as an indicator of variability in overall size and also as a part of the shape ratios (see below)
Width	W		
Thickness	Th		
	L_1	Distance from the base to the point of maximum width	Key variable in the determination of 'Pointedness'
Width at Tip	B_1	Width at $4/5^{\text{th}}$ Length	Minor variables – used for calculating other shape ratios.
Width at Base	B_2	Width at $1/5^{\text{th}}$ Length	
Thickness at Tip	T_1	Thickness at $4/5^{\text{th}}$ Length	

Table 5. 1: Summary of the relevant dimensions used in Roe's (1968) handaxe shape calculations.

For each of the assemblages outlined in Chapter 4, the measurements in Table 5.1 were taken manually using callipers and recorded for use in the subsequent analysis. The visual measurement of percentage of cortex was also recorded, with the aim of using it as a further means of comparison between individual handaxes. The use of these standard measurements has enabled comparison between the assemblages recorded in the course of data collection, with those that were available as pre-recorded datasets. The data is useful to address the assertions, as identified from the existing literature in Chapter 2, cited as representing key aspects of variation between Acheulean and Mousterian assemblages, namely that Mousterian of Acheulean Tradition handaxes have a higher elongation index than Acheulean handaxes and that there is greater statistical variability in the Acheulean than the MTA (Collins and Collins, 1970).

To facilitate the comparison of my data with that from Roe (1968), I calculated the indices for each assemblage I studied and used Roe's tripartite division to categorise them. The results of this analysis are tabled below and include, where available, the data from Roe (1968). Groupings marked in yellow reflect sites where the sample number is deemed insufficient to give an accurate representation of the overall assemblage. This was determined by the small sample size either in total, or relative to the number recorded by Roe (1968).

Site Name		Total Handaxes	Points	Ovates	Cleavers	Primary Group	Roe Group (pg 207)	Final Group
Boxgrove	N	201	40	156	5	Ovate Dominant		Group VII
	%		19.9	77.6	2.5			
Hitchin	N	25	17	8	0	Point Dominant		Group II
	%		68.0	32.0	0			
	Roe Data	79	60.0	39.0	0		Group II	
Swanscombe UMG	N	33	29	4	0	Point Dominant		Group II
	%		87.9	12.1	0.0			
	Roe Data	159	80.0	19.0	1.0		Group II	
Warren Hill	N	148	13	124	11	Ovate Dominant		Group VII
	%		8.8	83.8	7.4			
	Roe Data	636	13.0	86.0	1.0		Group VII	
Furze Platt	N	25	9	15	1	Ovate Dominant		Group I
	%		36.0	60.0	4.0			
	Roe Data	469	65.0	31.0	3.0		Group I	
Wolvercote	N	34	27	7	0	Point Dominant		Group III
	%		79.4	20.6	0.0			
	Roe Data	47	81.0	17.0	2.0		Group III	
Broom	N	253	94	149	10	Uncommitted Ovate		Group IV
	%		37.2	58.9	4.0			
	Roe Data	171	38.0	58.0	4.0		Group IV	
Great Pan Farm	N	82	47	32	3	Uncommitted Pointed		Group IV
	%		57.3	39.0	3.7			
	Roe Data	44	50.0	50.0	0.0		Group VI	
Pontnewydd	N	29	25	3	1	Point Dominant		Group I
	%		86.2	10.3	3.4			
Stanton Harcourt	N	29	15	12	2	Uncommitted Pointed		Group I
	%		51.7	41.4	6.9			

Site Name		Total Handaxes	Points	Ovates	Cleavers	Primary Group	Roe Group (pg 207)	Final Group
Biddenham	N	27	16	8	1	Ovate Dominant		
	%		64.0	32.0	4.0			
Berinsfield	N	23	12	11	0	Uncommitted		Group I
	%		52.2	47.8	0.0			
Bowman's Lodge	N	27	3	25	2	Ovate Dominant		Group VI
	%		7.4	85.2	7.4			
	Roe Data	29	25.0	72.0	3.0		Group VI	
Caddington	n	30	13	16	1	Uncommitted Ovate		Group VII
	%		43.3	53.3	3.3			
	Roe Data	35	20.0	75.0	5.0		Group VII	
Corfe Mullen	n	133	29	98	6	Ovate Dominant		Group VII
	%		21.8	73.7	4.5			
	Roe Data	45	18.0	78.0	4.0		Group VII	
Cuxton	n	192	86	87	19	Uncommitted		Group I
	%		44.8	45.3	9.9			
	Roe Data	160	57.0	40.0	3.0		Group I	
Bramford Rd	n	63	42	20	1	Ovate Dominant		Group VI
	%		66.7	31.7	1.6			
Lynford	n	46	30	15	1	Point Dominant		Group II
	%		65.2	32.6	2.2			
Oldbury	n	13	10	3	0	Point Dominant		Group VI
	%		76.9	23.1	0.0			
	Roe Data	31	29.0	68.0	3.0		Group VI	
Kents Cavern	n	4	4	0	0	Point Dominant		Group II
	%		100.0	0.0	0.0			
Coygan	n	3	3	0	0	Point Dominant		Group II
	%		100.0	0.0	0.0			

Table 5. 2 : Table of sites with percentages of Points, Ovates and Cleavers (with extracts from Roe, 1968).

For the 21 sites listed above (Red Barns was excluded due to insufficient data), each was assigned a primary grouping based on the percentage of points, ovates and cleavers, with assemblages containing 60% or more of one type termed Dominant, and those with 50-60% of one type termed Uncommitted (type). At this stage, of the assemblages with comparable data from Roe (1968), Oldbury, Cuxton, Caddington, Furze Platt and Great Pan Farm did not concur with expectations. For Oldbury and Furze Platt, it is probable that the substantially smaller dataset collected for this study

distorted the results, and in this case the attribution made by Roe should stand. Conversely, the Great Pan Farm assemblage was larger for this study than the dataset from Roe, and so the new data can be used to move the assemblage from Uncommitted to Uncommitted (Pointed). With Cuxton and Caddington, it is difficult to explain the differences in outcome, except possibly that a substantially higher number of cleavers in the present sample from Cuxton has altered the percentages: however, in both cases, the Final Group assignment has not changed.

The next step was to plot the remaining 20 sites onto a diagram representing the mean elongation (B/L) and mean width at tip/width at base (B_1/B_2) for each site, as Roe did with his 38 sites. As the cleaver chart is unnecessary, because none of the sites exhibited a cleaver-dominant profile, a combined graph showing all the sites was chosen over a tripartite diagram. Biddenham had to be omitted due to a lack of data for the B_1/B_2 formula.

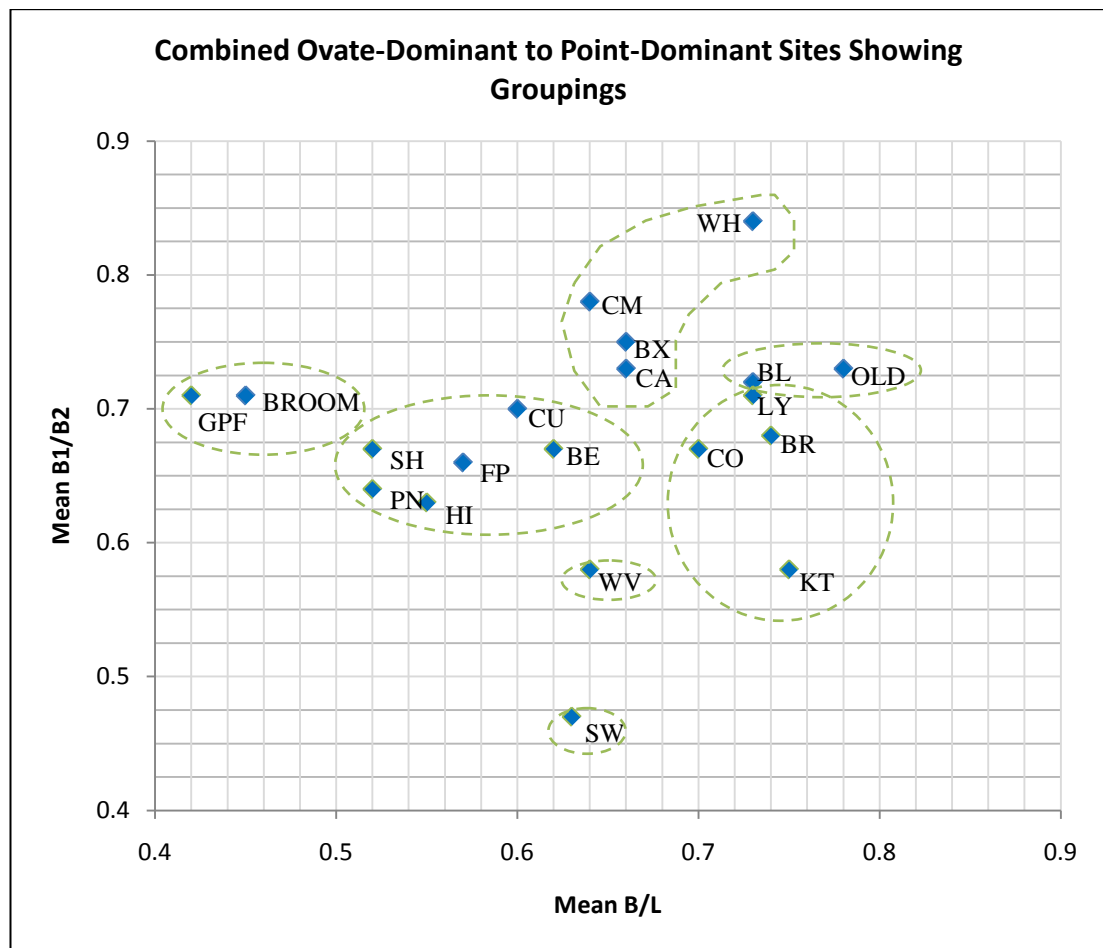


Figure 5. 1: Combined diagram showing the groupings of each site based on mean calculations (After Roe, 1968).

From this diagram, it is possible to make a preliminary grouping of the sites, which can then be further refined by including other aspects such as percentage of cleavers, presence of tranchet sharpening and the percentage of twisted handaxes. Roe devised seven groups on the basis of his tripartite diagrams:

	Group Name	Description
Pointed Tradition	Group I	Contains extreme points and cleavers, preference for narrow forms. Extremely large handaxes common, no twists and variable tranchet use.
	Group II	Combination of ovate and pointed forms, lack of cleavers. Variable tranchet use and twisted handaxes.
	Group III	Predominance of narrow, pointed forms, with plano-convex section.
Intermediate	Group IV	No dominant form, no dominant signature. Use of tranchet method and twisted handaxes in differing quantities.
Ovate Tradition	Group V	Characterised by thick, broad handaxes of a crude nature.
	Group VI	Contains 'pointed' ovate forms, with high percentage of twists and tranchet sharpening.
	Group VII	Contains ovate forms that approach the cleaver form. Very few pointed forms and a lower level of tranchet and twisted forms.

Table 5. 3: Table summarising Roe's Final Grouping descriptions (After Roe, 1968).

	Pointed			Int.	Ovate		
Period	Group I	Group II	Group III	Group IV	Group V	Group VI	Group VII
Early Lower Palaeolithic	<i>Hitchin</i> Swanscombe						Boxgrove Warren Hill
Late Lower Palaeolithic	<i>Furze Platt</i>		Wolvercote	GPF			
Undated Lower Palaeolithic	Cuxton Berinsfield					Bowmans Lodge	Caddington Corfe Mullen
Early Middle Palaeolithic	Pontnewydd Stanton H			Broom			
Late Middle Palaeolithic	Bramford Coygan Kent Cavern Lynford					<i>Oldbury</i>	

Table 5. 4: Table showing the groupings for the 20 sites analysed, displayed according to period. Sites in *italics* have preferred Roe's (1968) grouping over that suggested by my analysis.

What conclusions can be drawn from the results of this analysis? Firstly, regarding the distribution of groups within the dataset, it is possible to say that a wide range of different assemblage types are represented, with the exception of Group V. There is also no discernable period grouping, as was expected, with varying types of point- and ovate-dominant assemblages represented in all time periods. As noted earlier, it is not advisable to start making conclusions on the basis of this analysis save for concluding that there is a wide variety of variability represented in these 20 assemblages which is not chronologically patterned, and is not geographically linked.

5.3 ANALYSIS OF WHITE'S HYPOTHESIS

The raw materials analysis below is by no means intended to be an exhaustive look at the White (1998a) hypothesis. As previously indicated, the methodology used by White, including the measurement of residual cortex and reconstruction of original nodules, is not inherently replicable. Instead, I will look briefly at whether the data from the data set matches the basic premise of the raw material hypothesis, namely

that sites with access to good quality raw materials are ovate-dominated whereas sites with poor quality or conditioned raw material are point-dominated. The implications of this analysis and the other conclusions of the raw material hypothesis (White, 1998a) will inform the rest of the analysis in this chapter and will also be considered in greater detail in Chapters 6 and 7.

Table 5.5 (below) lists the sites in the study in period order and re-presents the point/ovate split for each site. It also adds the raw material quality and primary source for raw material as indicated in White (1998a) or from documented sources in Chapter 4. The green and red squares indicate whether the correlation between dominant type and raw material quality is as expected or not. Two thirds of the sites (14) in the dataset correlate as expected. Of the rest (7) three sites are from the LMP and contain *bout coupé* elements which are finely worked points, suggesting that the Mousterian sites are not directly applicable to White's (1998a) Acheulean-based hypothesis, one (Furze Platt) is skewed by the smaller sample size in this dataset compared to the one utilised by White (1998a). Red Barns is an extremely small sample size and is therefore unlikely to provide a good exception to the rule. Of the remaining two, Cuxton may provide a good counter point as it contains very pointed handaxes made on burrow flint but also many other forms which lead to an undominated assemblage. Great Pan Farm has an ambiguous raw material source and may be considered to be a multi-period assemblage.

Site	Period	Total Artefacts	Point/Ovate Ratio	Raw Material Quality	Correlates?	Primary Raw Material Source
Boxgrove	ELP	201	20:78	Fresh	Yes	Chalk
Hitchin	ELP	25	68:32	Fresh/derived	Yes	Glacio-fluvial gravels
Swanscombe	ELP	33	88:12	Derived	Yes	Fluvial gravels
Warren Hill	ELP	148	9:84	Fresh/derived	Yes	Fluvial gravels
Furze Platt	LLP	25	36:60	Derived	No*	Fluvial gravels
Red Barns	LLP	5	67:33	Good	No	Chalk
Wolvercote	LLP	34	79:21	Derived	Yes	Fluvial gravels
Broom	EMP	253	37:59	Fresh	Yes	Chert
Great Pan Farm	EMP	82	57:39	Good	No	Chalk?/Fluvial gravels
Pontnewydd	EMP	29	86:10	Poor	Yes	Glacial erratics
Stanton Harcourt	EMP	29	52:41	Poor	Yes	Glacio-fluvial gravels
Biddenham	ULP	27	64:32	Poor	Yes	Glacial gravels
Berinsfield	ULP	23	52:48	Poor	Yes	Glacio-fluvial gravels
Bowmans	ULP	27	7:85	Fresh	Yes	No immediate source
Caddington	ULP	30	43:53	Fresh	Yes	Clay with flints chalk
Corfe Mullen	ULP	133	22:74	Good	Yes	Fluvial gravels
Cuxton	ULP	192	45:45	Poor	No	Burrow flint
Bramford Road	LMP	63	67:32	Poor	Yes	Gravel?
Coygan	LMP	3	20:75	Good	Yes	Chalk
Kents Cavern	LMP	4	100:0	Good	No	Chalk
Lynford	LMP	46	63:33	Good	No	Chalk
Oldbury	LMP	13	77:23	Good	No	Chalk

Table 5. 5: Sites in the analysis with point/ovate dominance and raw material type. Green means the site matches with White's (1998a) correlation, red indicates a mismatch. *Smaller sample size in my dataset leads to a mismatch with White (1998a) who has Furze Platt as point-dominated.

Overall, it can be demonstrated that the dataset correlates well with the expectations of the raw material hypothesis (White, 1998a). The reasons for this, and a more in-depth look at the implications of the White study, is conducted in Chapter 7.

5.4 ANALYSIS OF MCPHERRON'S HYPOTHESIS

The data presented in Table 5.6 is drawn from 1425 individual handaxes from 22 different sites. Much of this data is derived from personal recording, although the complete Boxgrove dataset has been utilised (Boxgrove Project, 2006) and also the

complete Cuxton dataset from the Marshall database (Marshall *et al*, 2001). The nature of each individual assemblage is outlined below:

Site	Period	Total Artefacts	Point/Ovate Ratio	Planform	Refinement	Elongation	Tip Length
Boxgrove	ELP	201	20: 78	0.40 ± 0.06	0.37 ± 0.05	0.66 ± 0.05	73.75 ± 17.17
Hitchin	ELP	25	68 :32	0.31 ± 0.06	0.48 ± 0.12	0.57 ± 0.10	84.51 ± 29.07
Swanscombe	ELP	33	88 :12	0.27 ± 0.08	0.50 ± 0.08	0.64 ± 0.08	76.54 ± 21.91
Warren Hill	ELP	148	9: 84	0.44 ± 0.08	0.43 ± 0.11	0.71 ± 0.11	55.08 ± 18.29
Furze Platt	LLP	25	36: 60	0.37 ± 0.11	0.55 ± 0.09	0.57 ± 0.09	77.92 ± 25.96
Red Barns	LLP	5	67 :33	0.32 ± 0.16	0.61 ± 0.15	0.58 ± 0.08	64.52 ± 31.02
Wolvercote	LLP	34	79 :21	0.30 ± 0.07	0.48 ± 0.11	0.64 ± 0.12	82.05 ± 30.97
Broom	EMP	253	37: 59	0.38 ± 0.09	0.45 ± 0.09	0.67 ± 0.11	77.29 ± 24.35
Great Pan Farm	EMP	82	57 :39	0.35 ± 0.09	0.42 ± 0.11	0.71 ± 0.08	56.49 ± 13.97
Pontnewydd	EMP	29	86 :10	0.27 ± 0.10	0.52 ± 0.11	0.67 ± 0.11	79.59 ± 23.98
Stanton Harcourt	EMP	29	52 :41	0.35 ± 0.11	0.52 ± 0.12	0.64 ± 0.10	79.28 ± 26.17
Biddenham	ULP	27	64 :32	0.32 ± 0.08	0.55 ± 0.13	0.60 ± 0.08	78.07 ± 23.33
Berinsfield	ULP	23	52 :48	0.34 ± 0.12	0.48 ± 0.09	0.62 ± 0.08	82.43 ± 25.85
Bowmans	ULP	27	7: 85	0.41 ± 0.07	0.45 ± 0.08	0.73 ± 0.13	51.75 ± 17.23
Caddington	ULP	30	43: 53	0.37 ± 0.12	0.49 ± 0.14	0.66 ± 0.07	61.39 ± 17.67
Corfe Mullen	ULP	133	22: 74	0.42 ± 0.08	0.51 ± 0.16	0.64 ± 0.11	70.82 ± 20.35
Cuxton	ULP	192	45:45	0.37 ± 0.12	0.60 ± 0.13	0.60 ± 0.09	78.32 ± 30.71
Bramford Road	LMP	63	67 :32	0.32 ± 0.10	0.37 ± 0.06	0.74 ± 0.07	58.93 ± 15.60
Coygan	LMP	3	20: 75	0.13 ± 0.09	0.32 ± 0.04	0.70 ± 0.08	86.70 ± 51.07
Kents Cavern	LMP	4	100 :0	0.27 ± 0.05	0.34 ± 0.03	0.75 ± 0.03	76.63 ± 4.31
Lynford	LMP	46	63 :33	0.32 ± 0.13	0.34 ± 0.08	0.72 ± 0.06	69.14 ± 24.09
Oldbury	LMP	13	77 :23	0.29 ± 0.07	0.38 ± 0.05	0.78 ± 0.10	48.06 ± 12.17

Table 5. 6: Summary of data from each of the utilised datasets – **bold** indicates the dominant type.

The data presented over the following pages is designed to simplify the presentation of the data in Table 5.6. Each of McPherron's (1995) measurements is presented in turn – Relative Location of the Maximum Width (Planform), Elongation and Refinement – and the expected patterns outlined in Chapter 3 are compared to the actual results. This is done first by looking at the means for each assemblage, then by plotting each individual handaxe graphically. For the purposes of visual (and temporal) comparison, each period is presented on a separate graph. Following the graphs is a discussion of the results and a critique of McPherron's (1995)

assumptions with the implications for his theory. To refresh, the key measurements and terms utilised in this analysis are reproduced below:

Measure	Abbreviation	Description	Relevance
Length	L		The three basic measurements of size. Used in their own right as an indicator of variability in overall size and also as a part of the shape ratios (see below)
Width	W		
Thickness	Th		
	L1	Distance from the base to the point of maximum width	Key variable in the determination of 'Pointedness'

Table 5. 7: Summary of the key measurements utilised in McPherron's (1995) calculations.

Measure	Calculation	Expectation
Relative Location of the Maximum Width (Planform)	L1/Length	That low values for RLoMW will have high values for Tip Length (TL) and vice versa. This indicates that Ovates have smaller TLs than Points.
Elongation	Width/Length	That high values for Elongation will have low values for TL and vice versa. This indicates that handaxes that are long compared to their width (narrow, elongated) will have longer TLs than handaxes that are wide compared to their length (wide, not elongated).
Refinement	Width/Thickness	Both patterns are possible and have different implications. Handaxes will either have high Refinement values and low TL values (and vice versa) or high Refinement values and high TL values (and vice versa).
Tip Length (TL)	Length-L1	Key variable against which the three ratios above are compared to assess whether they vary predictably against TL.

Table 5. 8: Key ratios and terms used in the McPherron (1995) analysis.

The first graphical representations in each section use a box and whisker format to show the median value, the interquartile range and minimum/maximum value for each site. This format allows for the sites to be sorted according to period, median, interquartile range etc, permitting overall range to be compared with the median value and interquartile variation (See Figure 5.2). The green line marked on each planform chart shows the divide between point and ovate at 0.35. Lower figures indicate pointed assemblages. The larger graphs show a representation of each handaxe measured in the course of the study, separated into period. Where there is an

overall trend, this is illustrated by the linear trendline to facilitate easier comprehension.

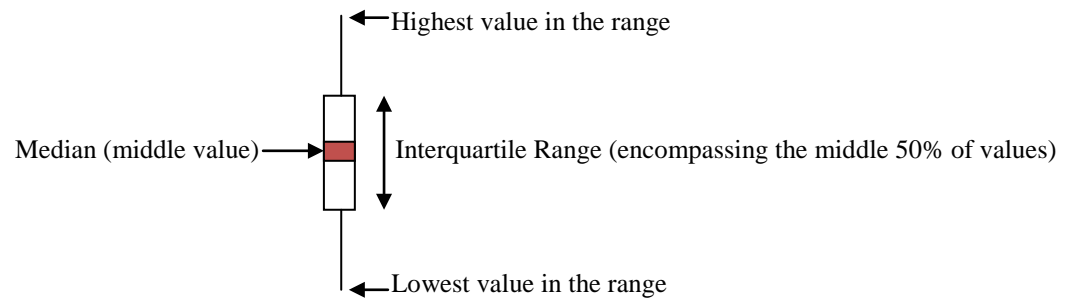


Figure 5. 2: Figure illustrating the values encompassed within the box and whisker format.

The abbreviations ELP (Early Lower Palaeolithic – MIS 11-13), LLP (Late Lower Palaeolithic (MIS 9-10), EMP (Early Middle Palaeolithic – MIS 8-7), ULP (Undated Lower Palaeolithic) and LMP (Late Middle Palaeolithic – MIS 3-4) are used in the figures and text, referring to the periods outlined in Chapter 4.

5.4.1 PLANFORM (L/L1)

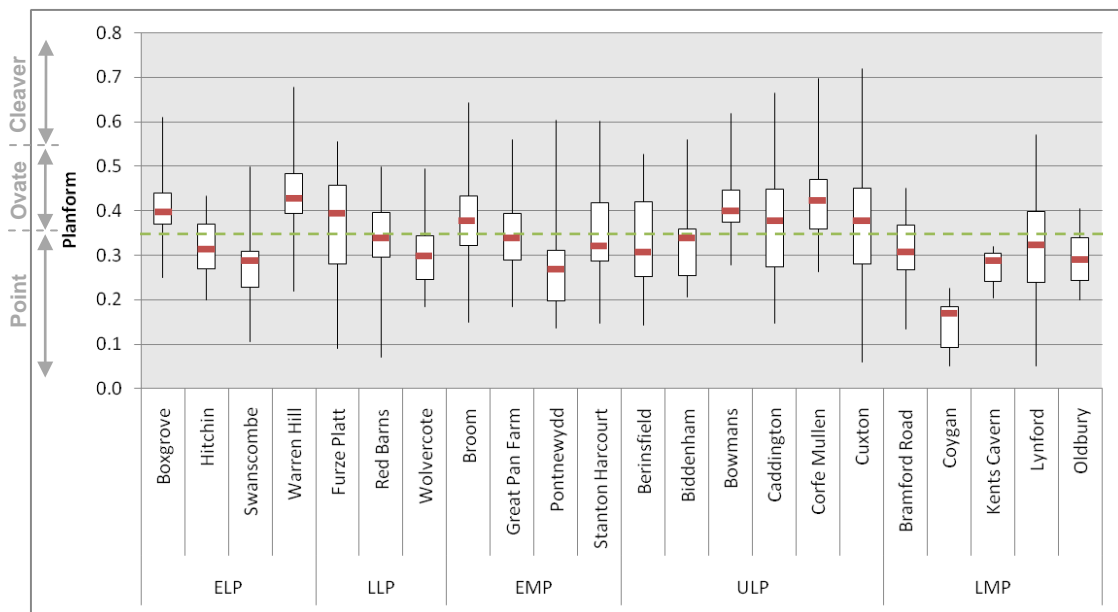


Figure 5. 3: Graph showing the median (red) and high/low/range values for Planform (sorted by period).

The first variable that is examined here is Planform – the relationship between length and the position of maximum width (L_1). Figure 5.3 shows the variation present within each site, sorted by period. This is to determine whether the range and spread of planform values varies chronologically. The ranges representing pointed, ovate and cleaver-type handaxes are also shown on the vertical axis. The overall picture is mixed, with only the LMP sites showing consistent median values below the point/ovate divide. McPherron (1995) used a similar diagram to illustrate that there was a substantial level of underlying variation beneath the label of an Ovate or Pointed Tradition assemblage. Undoubtedly this is the case for all of the British handaxe-dominated assemblages and is one of the key factors that needs to be considered when trying to explain variability. Roe (1968) assigned his initial groupings on the basis of the mean figure which, depending on the size of the assemblage, only represents a small percentage of the actual handaxes. The amount of variation within each assemblage can be demonstrated more clearly by sorting this

data by descending order of overall range (difference between highest to lowest value), as illustrated in Figure 5.4:

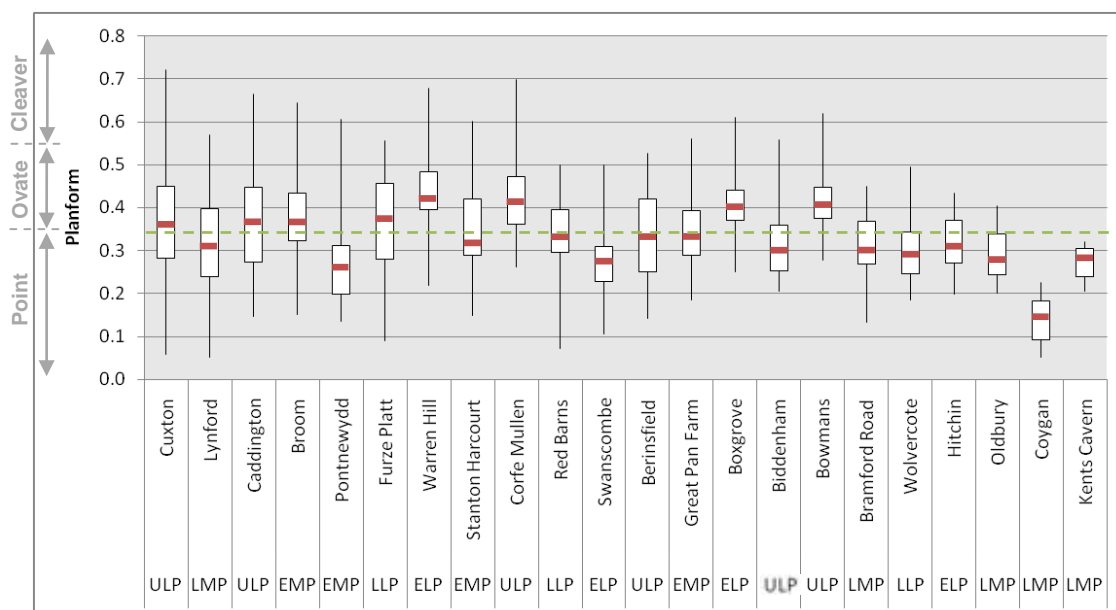


Figure 5. 4: Graph showing the median and high/low/range values for Planform (sorted by overall range).

Figure 5.4 demonstrates more clearly the variety of planform values present within the assemblages in this study. Interestingly, rather than showing a completely random pattern of sites, there is a notable divergence in the positioning of the LMP sites at both extremes of the spectrum. In the case of Bramford Road, Oldbury, Coygan and Kents Cavern, all are positioned at the least variable end of the chart. It could be argued that this is a product of the small sample sizes at these sites but the site of Beeches Pit (Gowlett, 2005) shows how a small sample can contain much variability. By contrast, Lynford exhibits one of the greatest ranges of variation in planform values, only exceeded by Cuxton. This contrasting pattern of variation is not mirrored by a relationship to either quality of raw material or the ratio of pointed/ovate forms. The other sites are fairly well distributed across the spectrum.

McPherron (1995) does not speculate as to what differing levels of variability may reflect, save that resharpening leads to a continuum of values. Theoretically, raw material may affect variability in different ways. It is probable that constraining raw

material would lead to a wider range of shapes as the knapper extracts the most useful form possible along a trajectory of least resistance (White, 1998a). However, where raw material is good quality and of sufficient size, a greater range of shapes are also possible. As Lynford has good quality raw material that is locally available, perhaps the range of variability relates to a more fluid form of handaxe manufacture with less emphasis on creating a standardised form. However, by extending McPherron's (1995) hypothesis, it could be argued that a greater range of variation within an assemblage reflects a mix of different intensities of resharpening. In such a scenario the hominins at Lynford were capable of exploiting flint in the form of handaxes from one extreme to the other, the *bout coupé* representing the most extreme form of pointed handaxe possible, in terms of the ratio of tip to butt. The lack of primary debitage at Lynford suggests that handaxes are being brought to site partially or totally finished and are then resharpened or recycled (White, *in prep*). Perhaps the variation at Lynford is indicative of handaxes at different stages in their use-life cycle, whereas at sites such as Oldbury and Bramford Road, handaxes are being discarded towards the end of their use-life in an exhausted or semi-exhausted state.

Sites such as Cuxton should exhibit larger ranges of variation indicative of a closer relationship between handaxe and raw material, which does not easily lend itself to shaping. Overall, Point-Dominated assemblages have smaller ranges (average=0.42) than those which are Ovate-Dominated (0.37) although the average is identical (0.42) if the restricted ranges from Oldbury, Kents Cavern and Coygan are removed. When the quality of raw material (Fresh or Gravel) is compared, there is again no significant difference in either range or median suggesting that, at the assemblage level, the range of variation is not linked to raw material type or dominant form.

Boxgrove shows a smaller range of variation than either Lynford or Cuxton, despite the possibilities afforded by good quality raw material. Perhaps here, the influence of a mental template (Ashton and White, 2003) is more readily applied, although under McPherron's (1995) model, the Boxgrove ovates would represent a resharpened form. White's (1998a) paper does not extend the raw material hypothesis into the Mousterian although theoretically Lynford should have a higher proportion of ovates, due to good quality raw material, not pointed handaxes as is the case.

Taking the relationship between variation and type further, if the overall range for ovates and points in each assemblage is compared (not illustrated), the numerically dominant type for each assemblage predominantly (19 of 22) shows a wider range of variation in planform than the minor group, amplified in those with a substantially higher proportion of one type. This would not perhaps be expected if ovates were created to a 'mental template' (Ashton and White, 2003), as a standardised form would by necessity produce a smaller range of variation. In fact, the three large assemblages with 3-9 times more ovates than points (Corfe Mullen, Boxgrove and Warren Hill) all show almost the full range of ovate planforms (0.351-0.550) and a restricted range of pointed planforms (0.200-0.350). This pattern is also echoed at Bowmans Lodge, where ovates outnumber points 2:1. It could be said that there is more variability in the dominant type simply because there are more of them. Whilst possible, numerical dominance does not dictate that all possible planforms would be utilised and, if accepted, would mean that there was no standardisation in production at all.

If McPherron's (1995) theory is extended to incorporate this finding, perhaps greater variability in the dominant form may reflect the reduction stage of the assemblage.

For McPherron, the point-dominated assemblage reflects handaxes in the early stages of reduction. Therefore the pointed handaxes show greater variability in this case, as not many have been substantially reduced. In an ovate-dominated assemblage, such as at Boxgrove, handaxes will have been more substantially reduced, leading to a predominance of ovates and also points which fall close to the point-ovate divide. At Boxgrove the full range of ovate types is representative of handaxes in varying stages of partial and full reduction. Although it is not possible to take these assertions further forward at this time, I will return to them in Chapter 7.

Returning briefly to Roe (1968), it is possible to examine his groupings to see if they are interpretively meaningful. The expectation is that each group would show some uniformity in at least one of the categories under examination here, especially as the percentage of each planform, combined with the shape diagrams, were used to define them. If not, it is more likely that the presence and absence of secondary features such as tranchet resharpening are more important in distinguishing between groups with the same dominant planform type than any aspect of shape.

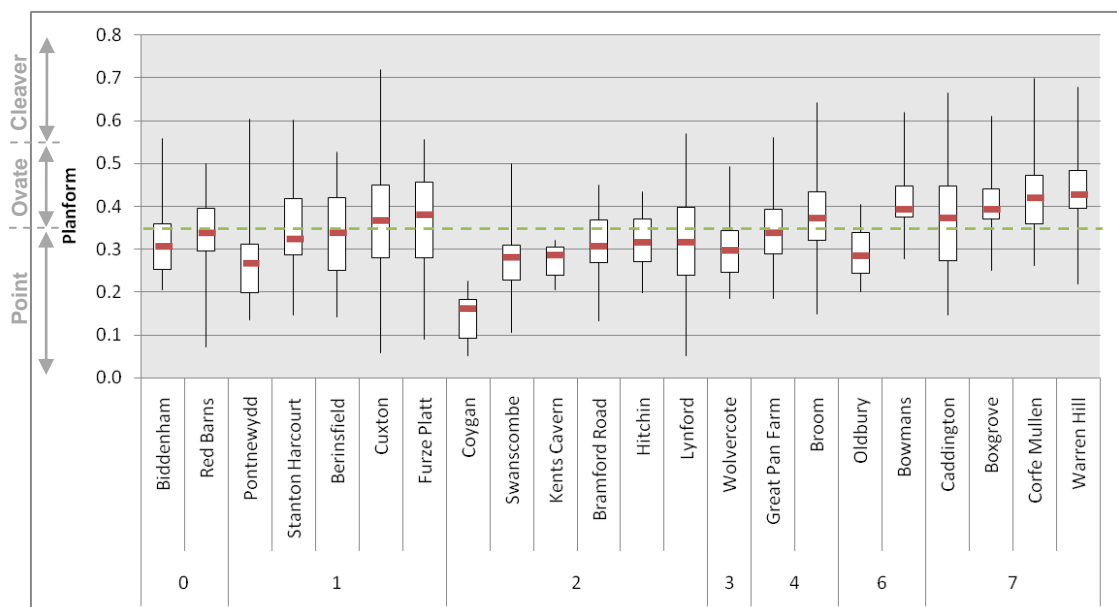


Figure 5. 5: Sites sorted by Roe (1968) grouping and then median (ascending).

Figure 5.5 sorts the dataset firstly by group, then by median. From this, it appears that some groups show more cohesion than others in terms of planform. Sites with small numbers of handaxes cannot be relied upon to demonstrate group cohesion. Group 1 sites appear to show a similarity in the interquartile and overall ranges. However, this visual similarity is not statistically significant. Overall, variation in planform does not appear to be linked to the Roe (1968) groupings.

The initial look at Planform variability within and between assemblages has produced some interesting insights, particularly in terms of variability related to chronological grouping. It will be possible to look at this again later in the chapter when the underlying assumptions of McPherron's (1995) hypothesis have been examined. The analysis performed above has been limited to whole assemblages and medians. It continues below by looking at the individual handaxes from each assemblage, in order to examine whether the trend from each site matches McPherron's predictions. Plotting each handaxe individually will allow for any patterns or extremes to be taken into account. The graphs below show each individual handaxe plotted with planform relative to tip length. This is a recreation of the graphs produced by McPherron (1995) to ascertain whether the same pattern of longer tip lengths equalling more pointed handaxes and shorter tip lengths equalling more ovate handaxes can be observed. Each period is considered separately to keep the number of handaxes on each chart to a workable level. Linear trendlines are included to show a best-fit alignment where appropriate.

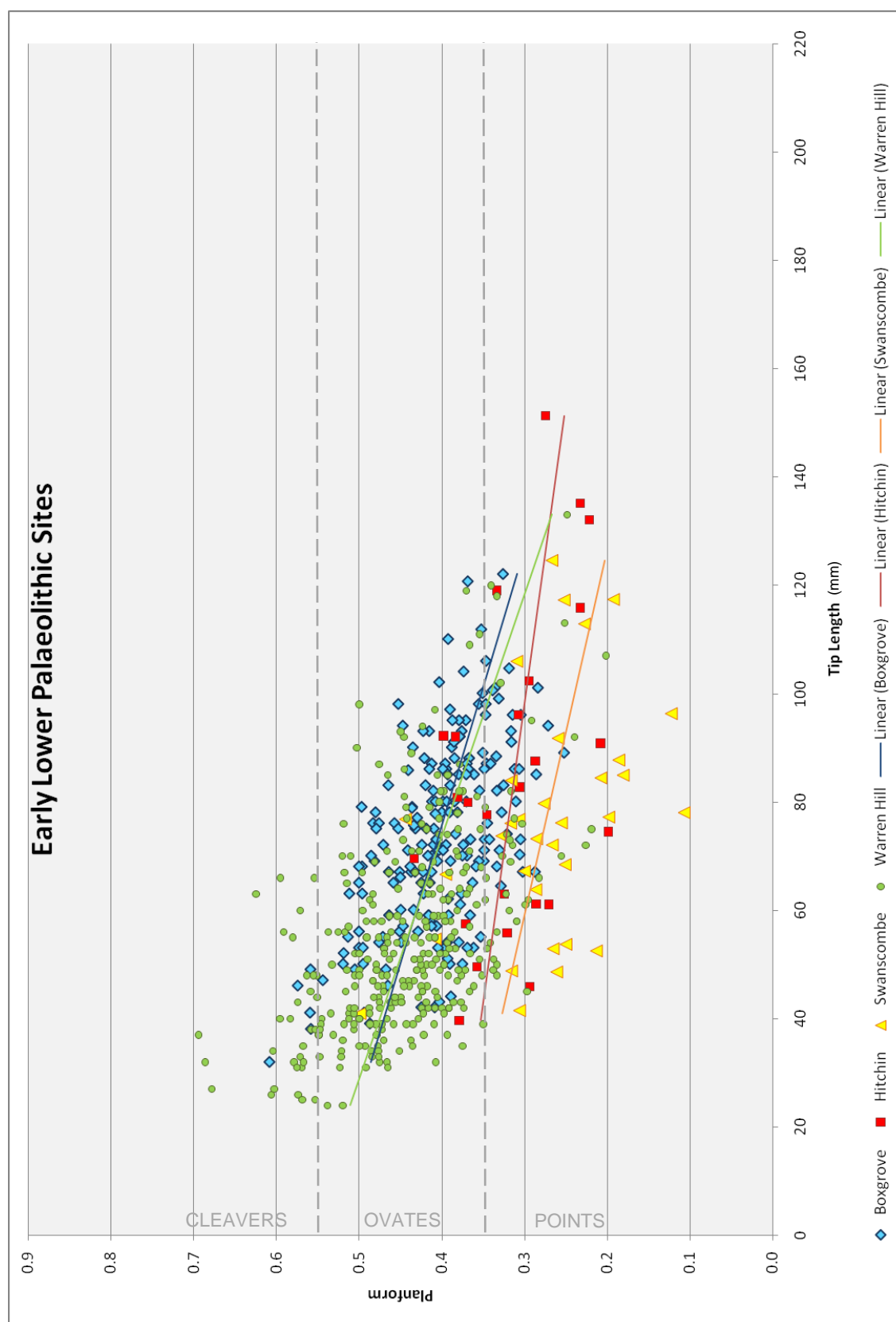


Figure 5. 6 : Graph showing the ELP handaxes when TL is plotted against Planform.

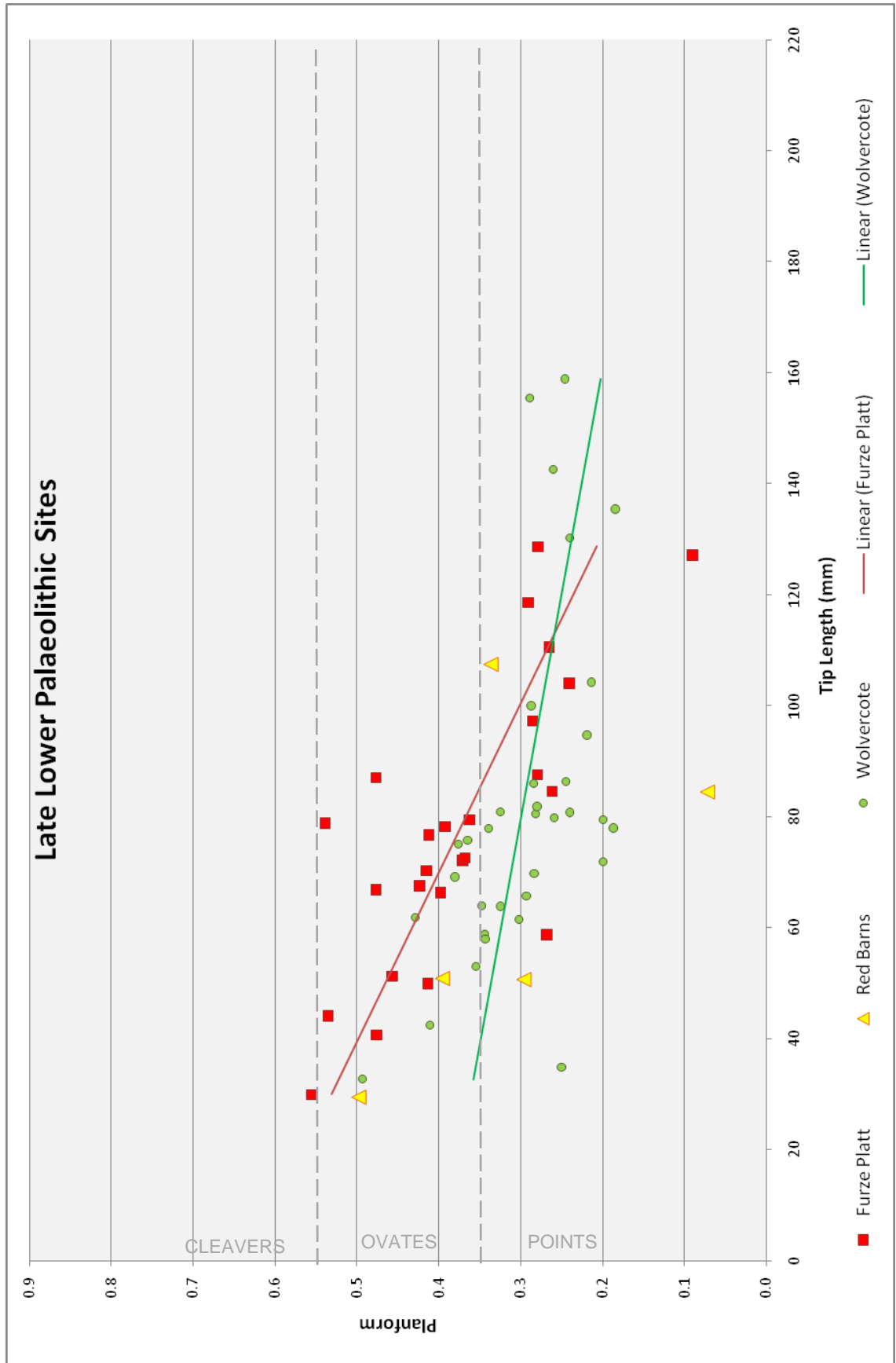


Figure 5. 7: Graph showing the LLP handaxes when TL is plotted against Planform.

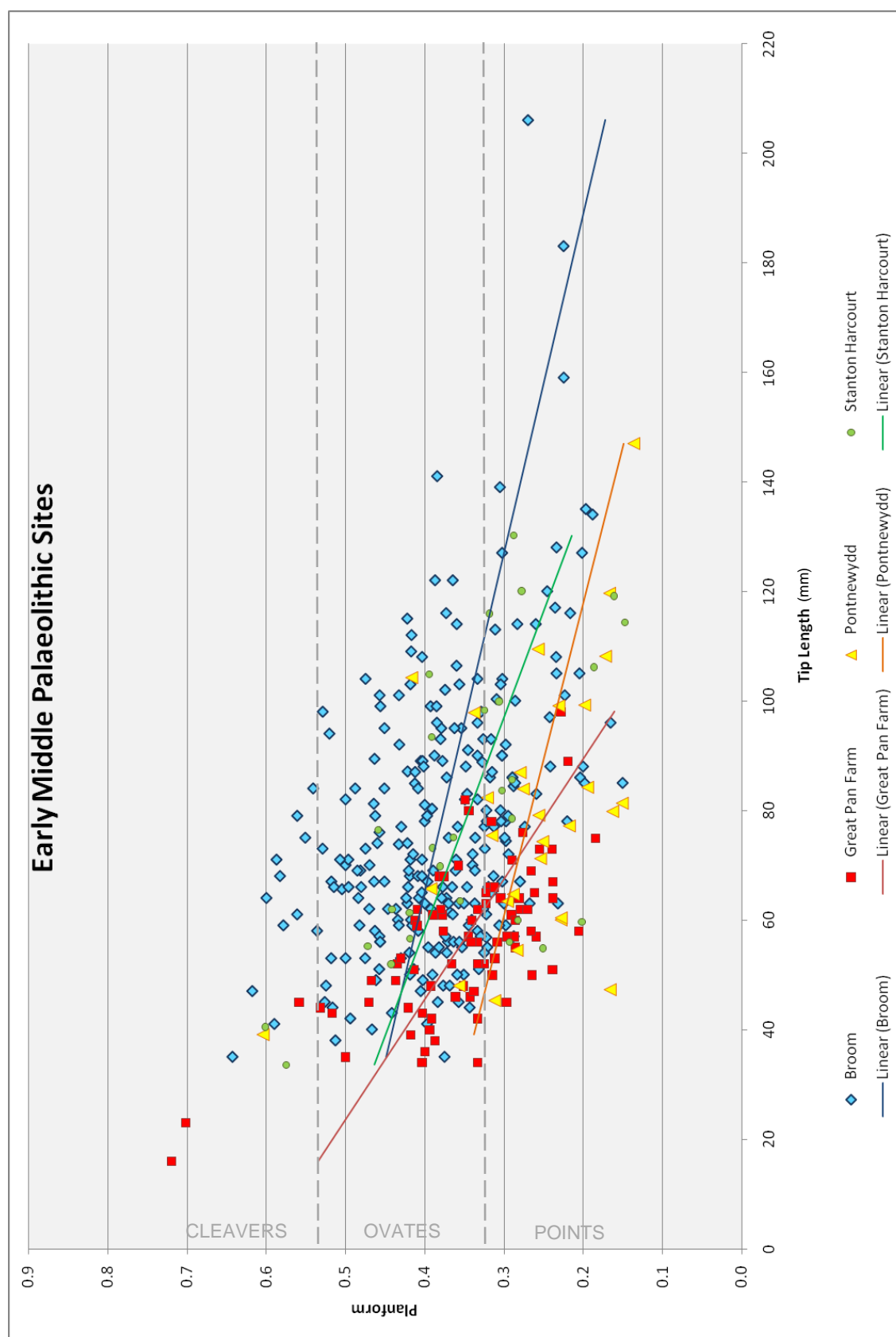


Figure 5. 8: Graph showing the EMP handaxes when TL is plotted against Planform.

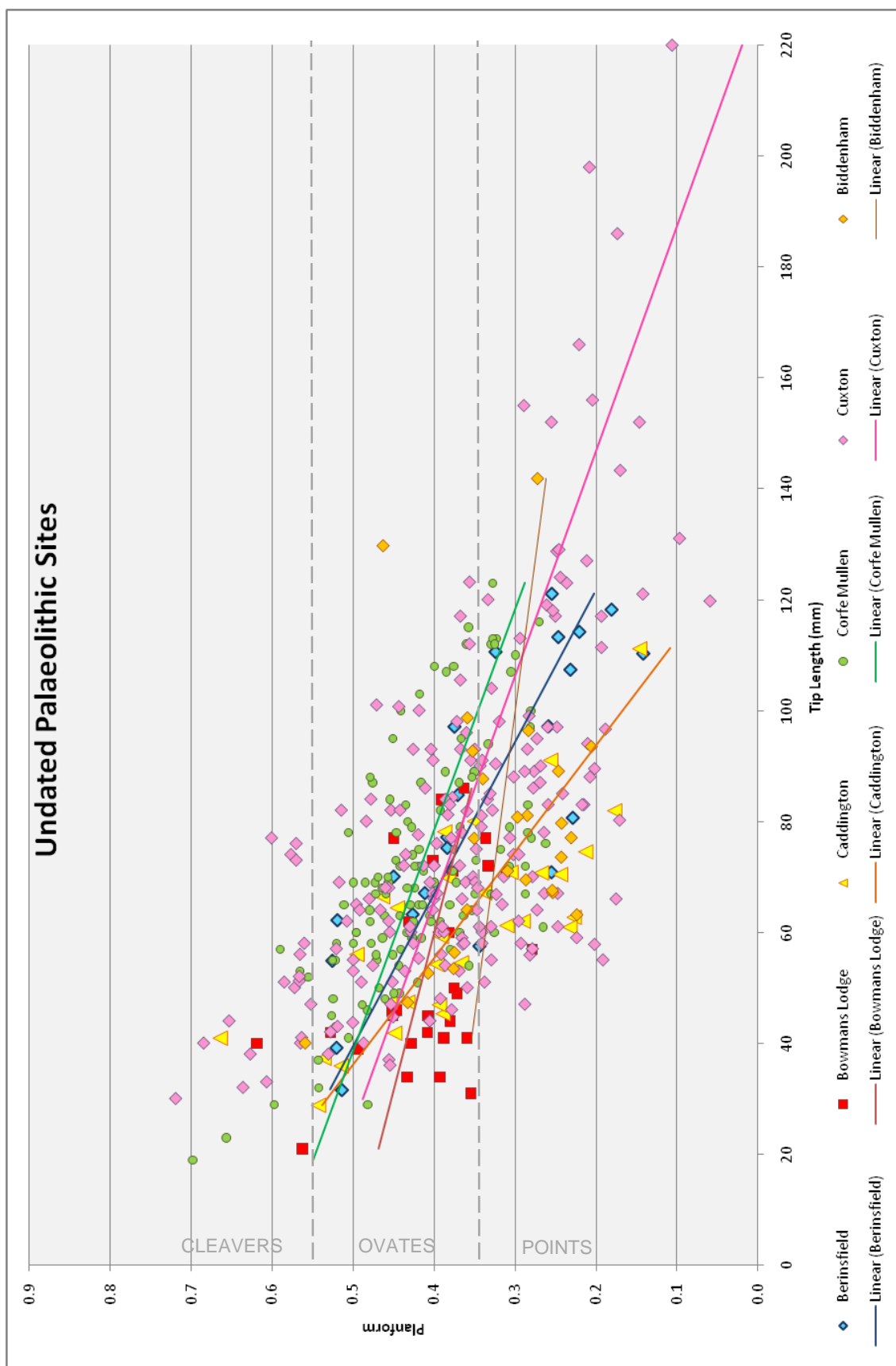


Figure 5. 9: Graph showing the ULP handaxes when TL is plotted against Planform.

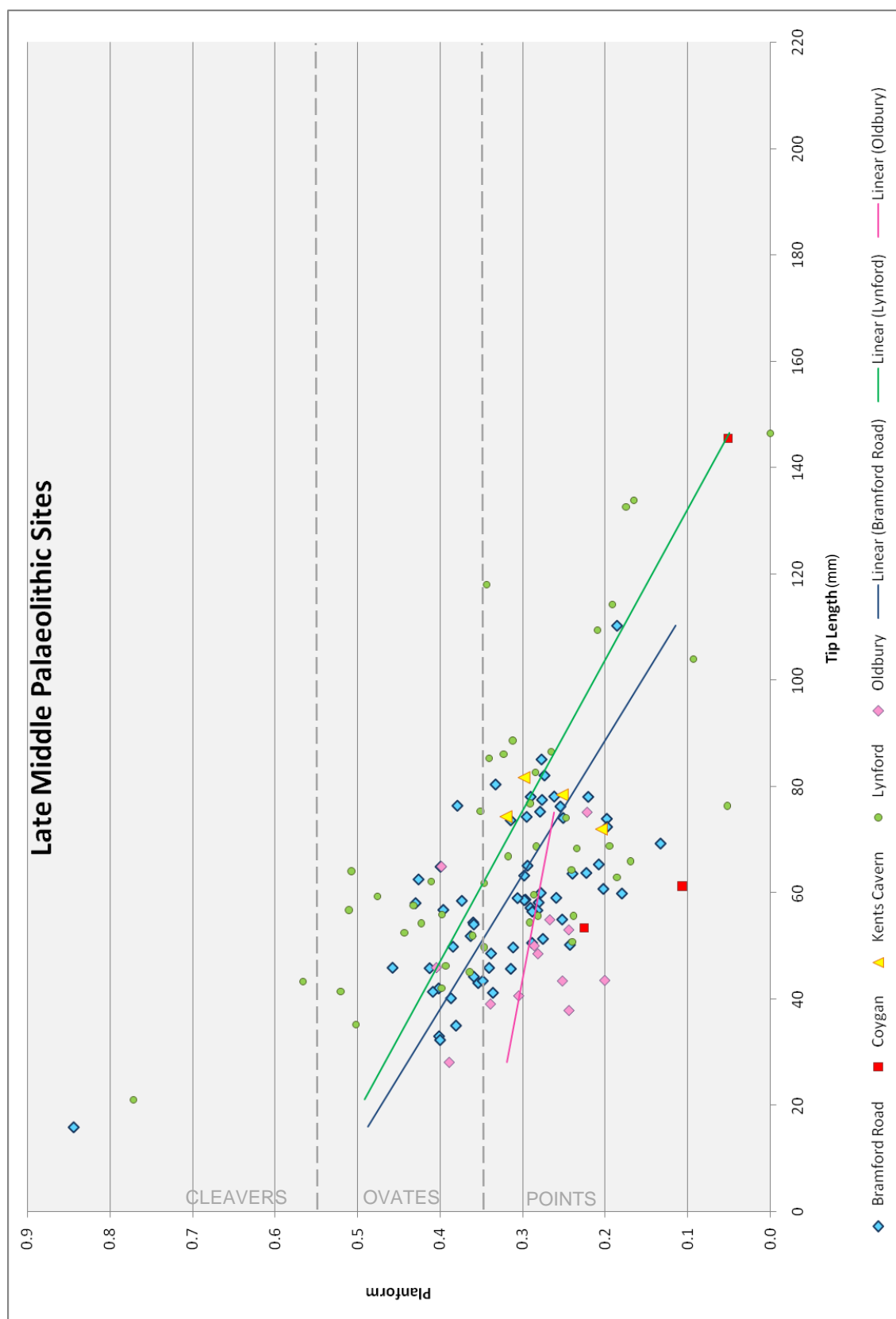


Figure 5. 10: Graph showing the LMP handaxes when TL is plotted against Planform.

From Figures 5.6-5.10 it is possible to see that the data does indeed conform to McPherron's (1995) expectations. For the majority of sites, the trend is for handaxes with long tip lengths to fall in the pointed end of the spectrum, changing to shorter tip lengths falling in the ovate and cleaver end of the spectrum. This means that, regardless of overall handaxe length, handaxes with longer tips are more likely to be points than those with shorter tips, which are more likely to be ovates. When handaxes are plotted with maximum length relative to planform there is no such correlation. What is also observable is that the majority of all handaxes fall within a restricted range of values from 0.20 to 0.50. There appears to be a core of limited variation within which 80-90% of the handaxes fall, combined with a range of handaxes at the two extremes of the spectrum, the majority of which are cleavers and highly pointed forms. The figures for each period are:

Period	Percentage of handaxes < 0.20 or > 0.50
ELP	11%
LLP	11%
EMP	12%
ULP	17%
LMP	18%

Table 5. 9: The percentages of 'extreme' handaxes from each study period.

I would suggest that the reasons for the enlarged percentage of 'extreme' handaxes in the latter two periods are firstly, that the presence of Cuxton in the ULP grouping, with its component of large elongated pointed handaxes, has a distorting effect on the overall total as well as the possibility that several periods are represented within this one chronological group. Indeed, the percentage figure of 'extreme' handaxes for Cuxton alone is 21%. Conversely, for the LMP, the presence of a component of bout coupé handaxes in each site would lead to a similar increase in the < .20 category (extremely pointed – butt length less than 20% of total length) as the flat-buttend

cordiform shape leads to an 'extreme' in the position of the point of maximum width. For these reasons, there does not appear to be an increase through time in the number of 'extreme' handaxes, with the majority of sites exhibiting c.80% of handaxes within the 0.20-0.50 range of planform. There is also a narrowing of range dependent on whether there is a large percentage of either points or ovates in the assemblage, for instance both Boxgrove and Warren Hill have approximately 80% of handaxes in the ovate range, of which 75% and 74% respectively are between 0.35-0.50.

Amalgamating the findings of the above analysis, it is evident that there is little patterning in planform and variation in planform with relation to chronological order or raw material/predominant shape. The one interesting observation is the perceived increase in variability at Lynford as opposed to the other LMP sites, which will be examined further in a later section. It is notable that the assignment of point- or ovate-dominated to an assemblage can mask a large or small level of variation from the average. Sites showed greater variation within the dominant planform, casting doubt on the notion of a mental template. With reference to the resharpening hypothesis, it seems that the data conforms to McPherron's (1995) observations, and that pointed handaxes do indeed have longer tip lengths than ovates, regardless of maximum length. The question that remains is whether or not this pattern in the data is indeed due to the resharpening of pointed handaxes into ovate ones.

ANALYSIS OF PLANFORM RESULTS

From the above results, McPherron's (1995) patterning of long tipped points to short tipped ovates seems to be verified. But there are several assumptions made by McPherron (1995) that may make the patterning in the data less significant. One of

the key assumptions in the McPherron (1995) argument is that the raw material used must have originally been identical in size, meaning that all handaxes were made from the same sized block of raw material. The idea of this assumption is to produce a baseline against which variation can be measured, with the notion that if raw material size is constant, then variation in handaxe size is reflective of the amount of reduction to which it has been subjected. This is supplemented by analysing the amount of cortex remaining versus the size of a handaxe, with the assumption that larger handaxes should have more cortex remaining than smaller handaxes (McPherron, 1999). Given this assertion it is possible to assess the implications of this assumption with relation to Planform.

If all nodules are the same size, then the tip length of an ovate handaxe will always be less than that of a point, even if both are the same length. This is because Tip Length (TL) is the measure of Length (L) minus L_1 (Planform is L_1/L). According to Roe (1968), an ovate must have a planform value of over 35% of its length, meaning that the maximum TL is 64% of total length. A point will have a TL of between 100% and 65% of its length. Therefore, given a constant raw material size, it is impossible for an ovate handaxe to exceed either the Planform value or the Tip Length of a pointed handaxe even if manufactured at the very beginning of the knapping process (see Figure 5.11).

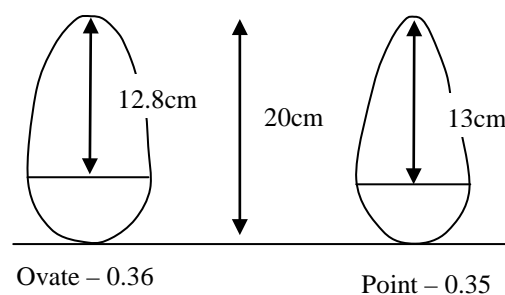


Figure 5. 11: Illustration of the relative Tip Lengths of an ovate and point of identical length.

With this in mind, it is clear that the patterning evident in the data cannot be sustained under an assumption of constant raw material size. In order to reverse the statistical trend, ovate handaxes would have to be manufactured consistently on raw material that was larger than that used to make pointed handaxes, in contradiction to the findings of White (1998a) who states that more of the original nodule is removed to create an ovate than to create a point. It is possible to illustrate the problem with asserting a linear pattern for planform reduction when raw material size is constant (Table 5.10) by converting a pointed handaxe into an ovate with the same Tip Length. A 187mm long, pointed (0.15) handaxe from Cuxton with a Tip Length of 152mm is converted into an ovate with a planform value of 0.40:

		Actual Length (mm)	Planform	Tip Length (mm)	Calculated Length (mm)
Cuxton Handaxe	Pointed	187	0.15	152	
	Hypothetical Ovate		0.4	152	253
Difference:					66

Table 5. 10: Conversion of a Cuxton point into a hypothetical ovate with the same Tip Length.

The conversion is done by multiplying the Tip Length by the Planform value to get the hypothetical length (253mm). This illustrates precisely the problem with this measurement, as the ovate would have to be over 60mm longer just to equal the Tip Length of the point. The measurement of Planform is therefore void in terms of providing support to the theory that pointed handaxes are reduced down into ovate handaxes.

5.4.2 ELONGATION (W/L)

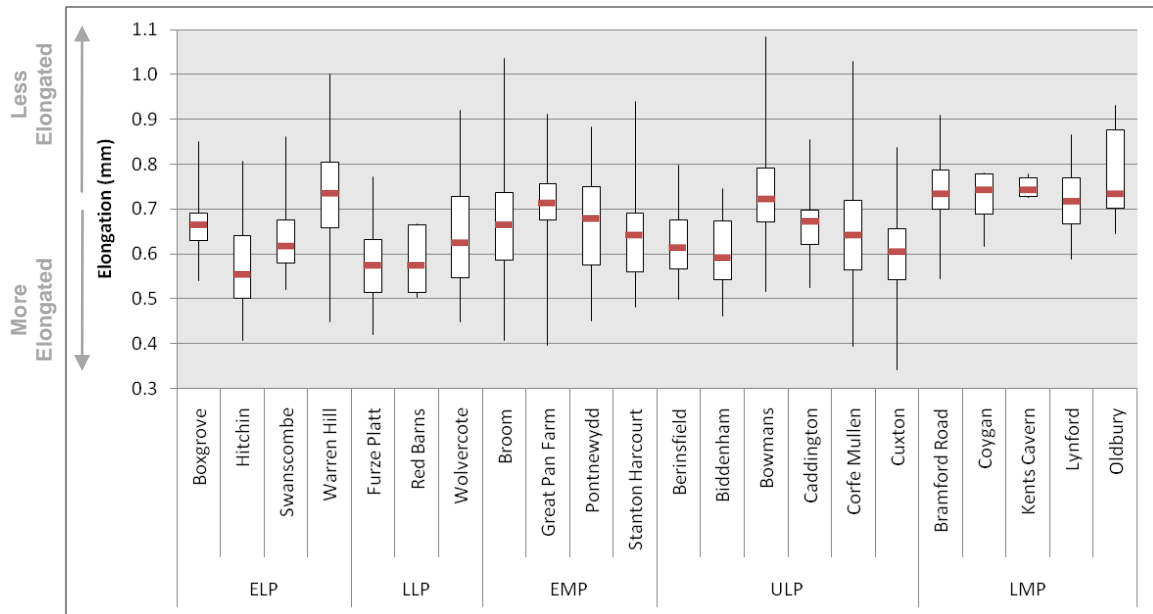


Figure 5. 12: Graph showing the median and high/low/range values for Elongation (sorted by period).

The second variable under scrutiny here is elongation – the relationship between length and width (W/L). A figure of 0.5 would represent a handaxe that is twice as long as it is wide, figures higher than 0.5 equal less elongated handaxes and lower figures equal more elongated handaxes. Anything over 1.0 and a handaxe is wider than it is long. Figure 5.12 shows the variation present in elongation within each site, sorted by period. The overall pattern is mixed, with only the LMP sites appearing to show a consistency in median values at the less elongated end of the spectrum. None of the sites have a median below 0.5, indicating that the majority of handaxes have a width that is wider than half their length. The LMP handaxes exhibit average profiles consistent with widths approaching 75% of the length, indicating a shorter, wider profile. It is also interesting to note the discrepancy between Boxgrove and Warren Hill in this diagram, two sites which have similar planform profiles and access to good raw materials. Boxgrove shows a far more restricted range of variation and contains on average more elongated handaxes than Warren Hill. It would be

interesting to look at this more closely in a future section. Overall, a number sites show a fairly restricted range of variation within the interquartile range, with a wide range of outliers, especially noticeable within the EMP and some ULP sites.

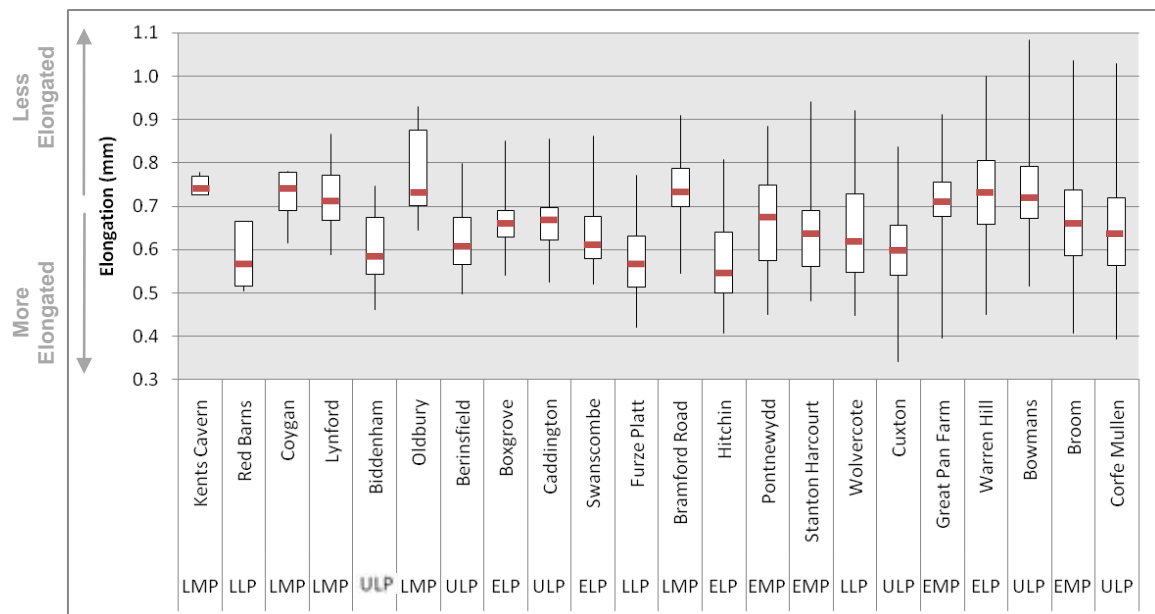


Figure 5. 13: Graph showing the sites sorted by overall range values (ascending) for Elongation.

Figure 5.13 demonstrates clearly the variety of different ranges exhibited by the assemblages in this study. It shows the sites sorted by overall range, with those sites showing the most variation in elongation falling on the right hand side of the diagram. Most immediately obvious, is the grouping of LMP and EMP sites at opposite ends of the diagram, with the exception of Bramford Road. Whilst it is plausible to suggest that the reason for the lack of variation in the three leftmost sites is due to the small size of the assemblages, the same cannot be said for either Lynford or the EMP sites which have much larger assemblages. The figure also illustrates that the mean value of elongation for each site is not related to the overall range of variation as sites with relatively more or less elongated handaxes are spread across the chart. Sites with a greater overall range could be said to reflect a continuum of resharpening, with the most elongated handaxes reflecting the least

resharpening as suggested by McPherron (1995). Greater variation here can also be linked to the size of the assemblage with 5 of the 6 larger assemblage sites clustering to the right hand side of the chart, with the exception of Boxgrove. There is no definitive reason why larger assemblages should show more variation than smaller ones, save that a larger number of individual artefacts affords more potential possibilities. The fact that Boxgrove handaxes do not show a more varied range of values would seem to suggest that there are non-random factors controlling the production of handaxes there. Since raw material quality and availability are not controlling factors, either Boxgrove handaxes represent more reduced handaxe forms (McPherron, 1995) or perhaps a preferred form (Ashton and McNabb, 1994).

The following figure shows the same data sorted by median (ascending) in order to assess whether there is chronological patterning related to whether an assemblage is more or less elongated on average:

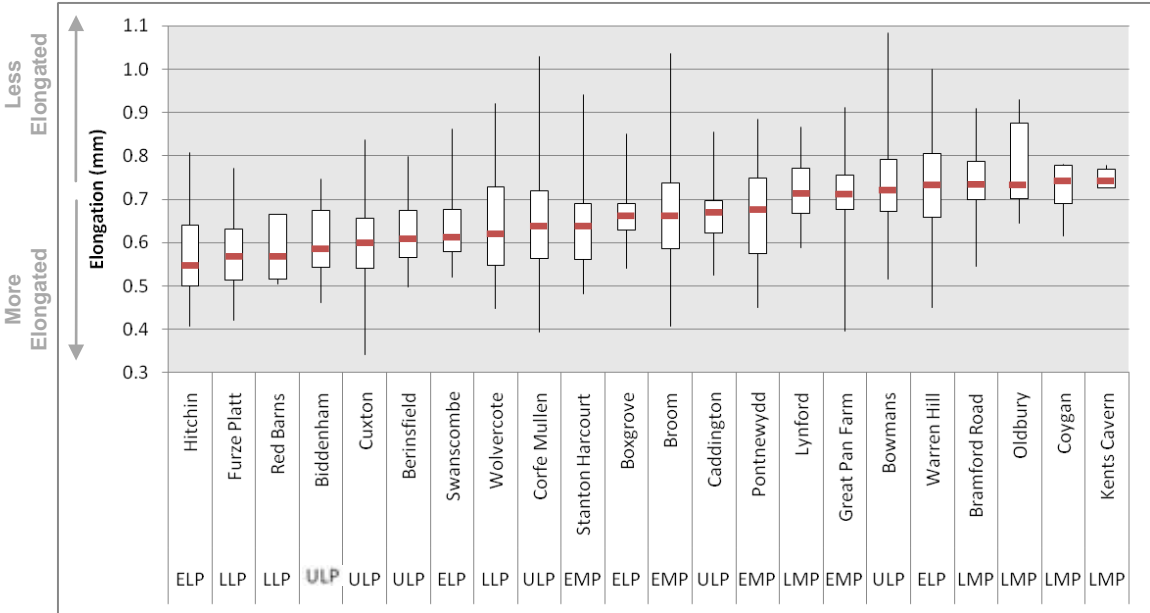


Figure 5. 14: Graph showing the sites sorted by median (ascending) Elongation (narrow/elongated to wide/short).

Figure 5.14 shows that the LMP sites are clustered to the right hand side of the diagram, echoing the observation made about Figure 5.12. Lynford is the only site which is slightly distanced from the other four, but still within the least elongated third. The sites appear clustered ELP/LLP to the left, LMP to the right and EMP in the middle. When compared with Roe’s (1968) groupings the following is observable:

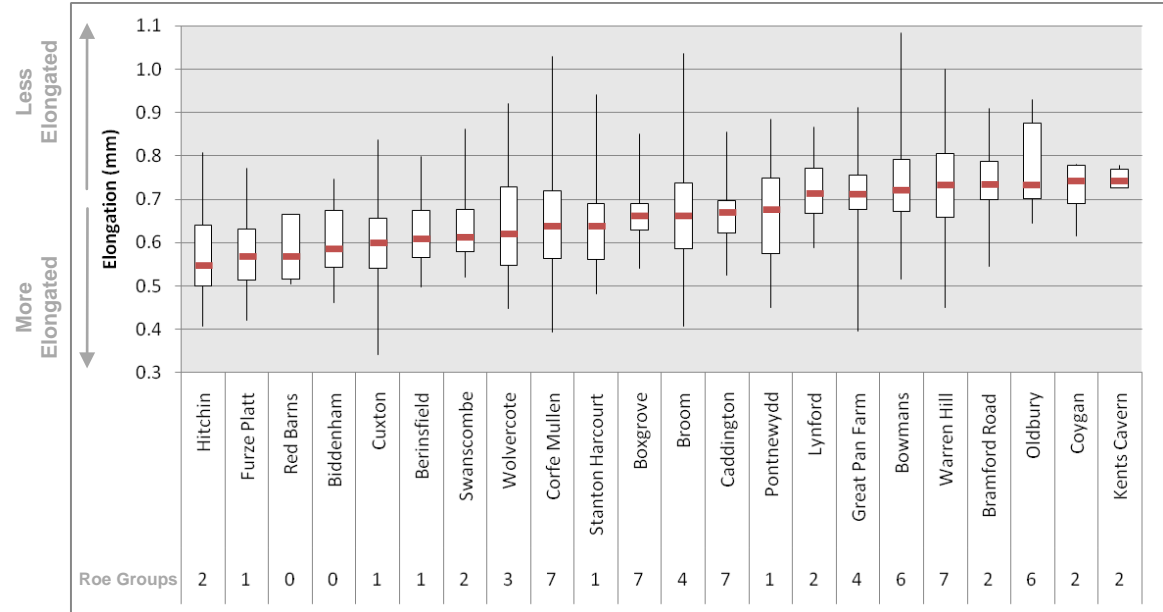


Figure 5. 15: Graph showing the sites sorted by median (ascending) Elongation (narrow/elongated to wide/short) Numerical figures relate to Roe (1968) groupings.

To refresh, Roe’s (1968) Groups 1-3 are Point-Dominant, Groups 6-7 are Ovate-Dominant and Group 4 is Intermediate. When looking at Figure 5.15, the pointed groups mostly fall at either end of the diagram, and are sorted by ELP to the left and LMP to the right, indicating that Point-Dominated groups vary differently with regards to Elongation depending on the period in which they were created. There is far less coherence in the Ovate and Intermediate groupings, with Elongation seemingly a less influencing factor. This is only partial support for Roe (1968) who separated Group I and Group II partly on the basis of a perceived higher elongation in Group I than Group II. Collins and Collins (1970) observed the same pattern when studying the Oldbury assemblage, with Mousterian of Acheulean Tradition handaxes

consistently having a higher elongation index than Acheulean handaxes. Higher elongation averages (less elongated handaxes) may be a result of an external constraint, such as raw material size (White, 1998a), but can also be a result of intensive resharpening. This is indicative of hominins transporting handaxes around the landscape (Kelly, 1988), an aspect that is considered in Chapter 7. If a divergence can be further substantiated, it would be an important distinction between Acheulean and Mousterian handaxes, indicative of different types of hominin behaviour.

The expectation of McPherron's (1995) hypothesis is that the assemblages with a dominance of pointed handaxes would have a lower Elongation value, indicating that they were more elongated. The above figures do not conclusively demonstrate a relationship, with some patterning in the Pointed assemblages varying with period and seemingly no patterning in the Ovate assemblages. Unexpectedly, the Cuxton average was not the lowest Elongation median, although the variation in overall range serves as an indicator of its unique, elongated pointed handaxes.

In an earlier pilot study I undertook with fewer sites, Boxgrove was positioned directly in the centre of the range for median, just as it is now. At the time, I posited that this was an insight into the different factors that influence bifacial manufacture at the site. Boxgrove would be considered one of White's (1998a) 'unconstrained' assemblages as hominins utilising the landscape would have had immediate access to large quantities of good quality raw material (Pope, 2002). If we exclude outliers from the analysis and instead concentrate on the interquartile range which represents the middle 50% of variation in the assemblage the following graph can be produced:

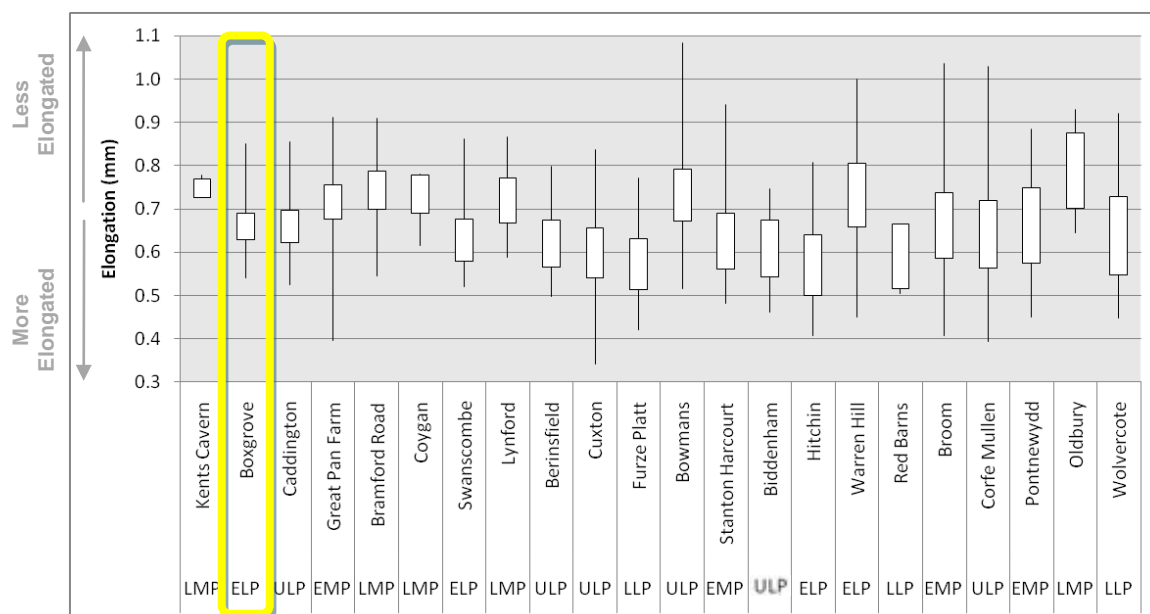


Figure 5. 16: Graph showing the sites sorted by interquartile range (ascending) for Elongation.

From Figure 5.16 it is possible to demonstrate that, with the exception of Kents Cavern, Boxgrove has the smallest interquartile range of the sites under study. There is a distinct lack of variation for the middle 50% of handaxes, all between 0.63 and 0.69 Elongation. The overall range is also the smallest for a site with over 35 handaxes. Boxgrove is therefore in contrast to the expectation of a greater range of variation when the knappers' decisions are unconstrained by raw material. The uniqueness of the Boxgrove handaxes will be considered further in Chapter 7.

The initial look at Elongation variability within and between assemblages has produced some interesting insights, particularly in relation to Boxgrove and also the difference between Mousterian and Acheulean handaxes. It will be possible to look at this again later in the chapter. The graphs below show each individual handaxe plotted with elongation relative to tip length. This is a recreation of the graphs produced by McPherron (1995) to ascertain whether the same pattern of more elongated figures equalling more pointed handaxes and less elongated figures equalling more ovate handaxes can be observed.

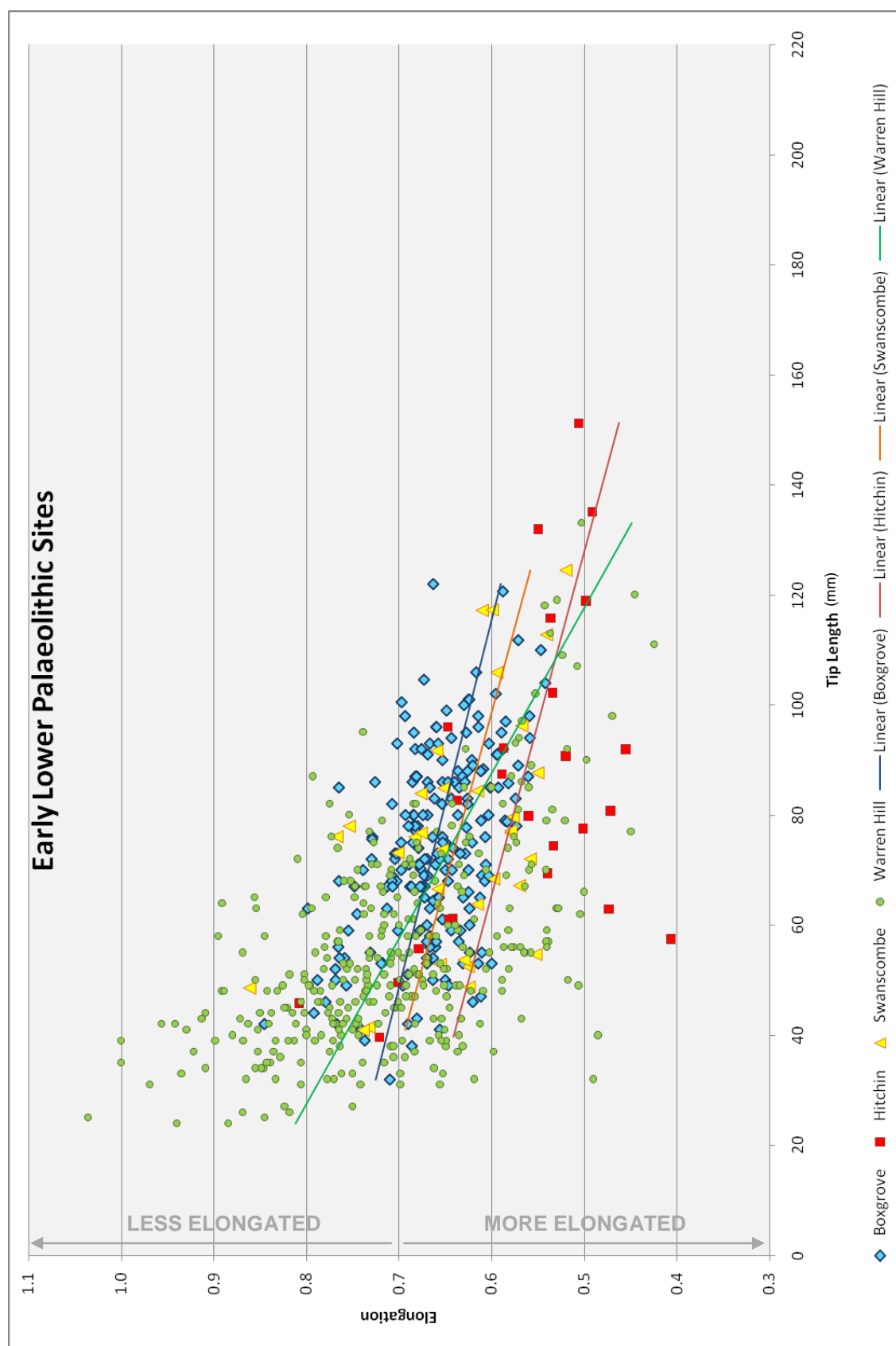


Figure 5. 17 : Graph showing the ELP handaxes when TL is plotted against Elongation

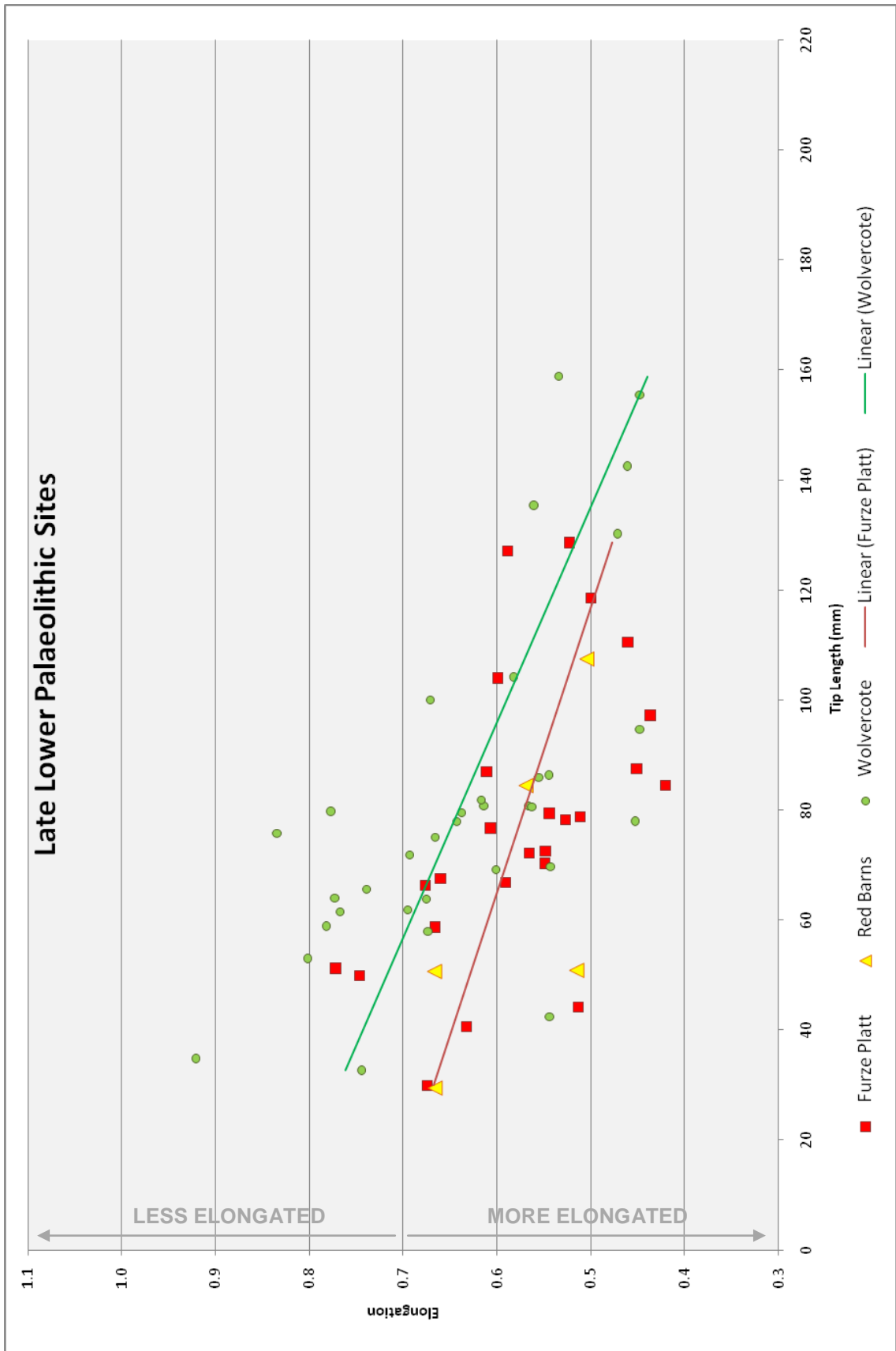


Figure 5. 18: Graph showing the LLP handaxes when TL is plotted against Elongation

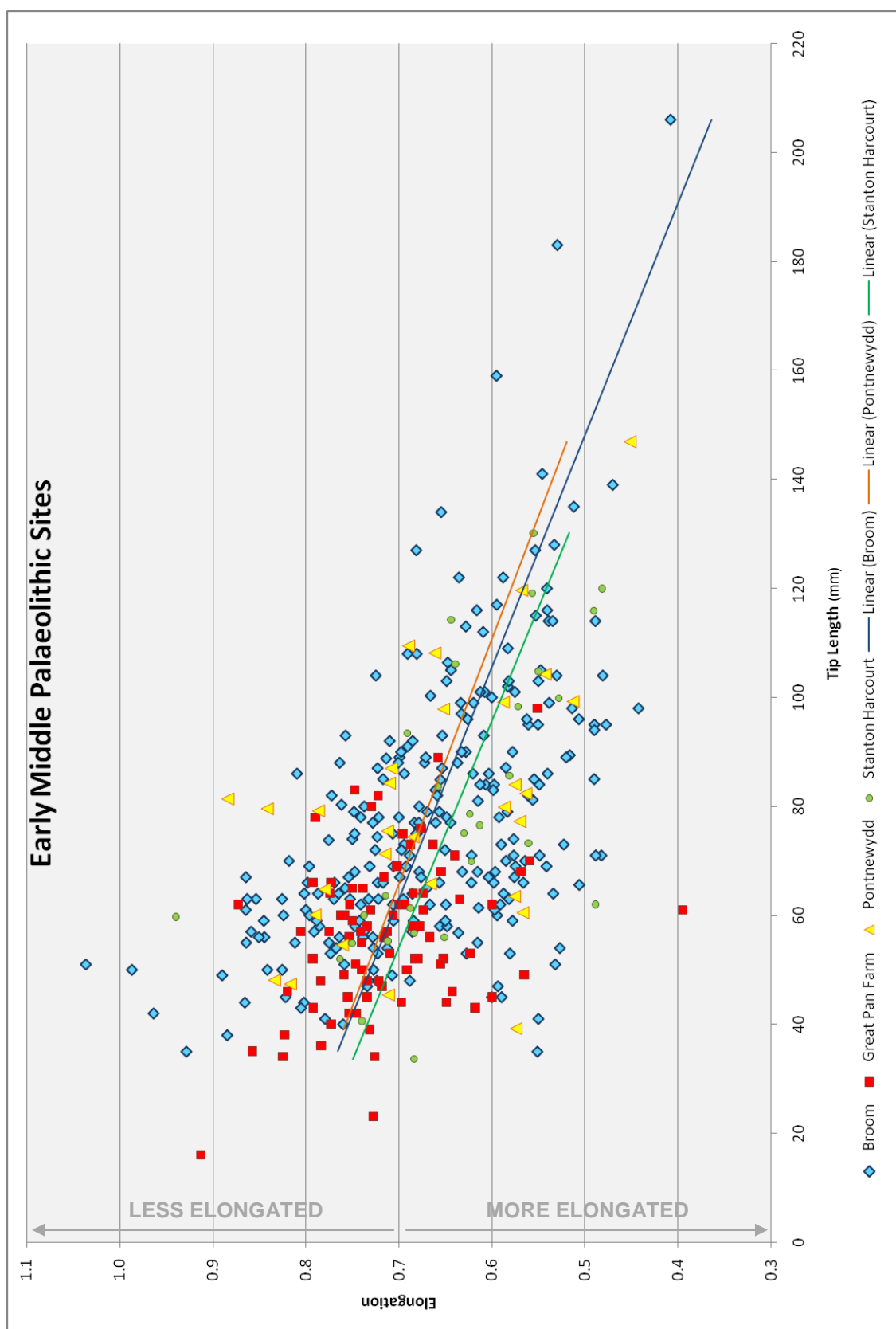


Figure 5. 19: Graph showing the EMP handaxes when TL is plotted against Elongation

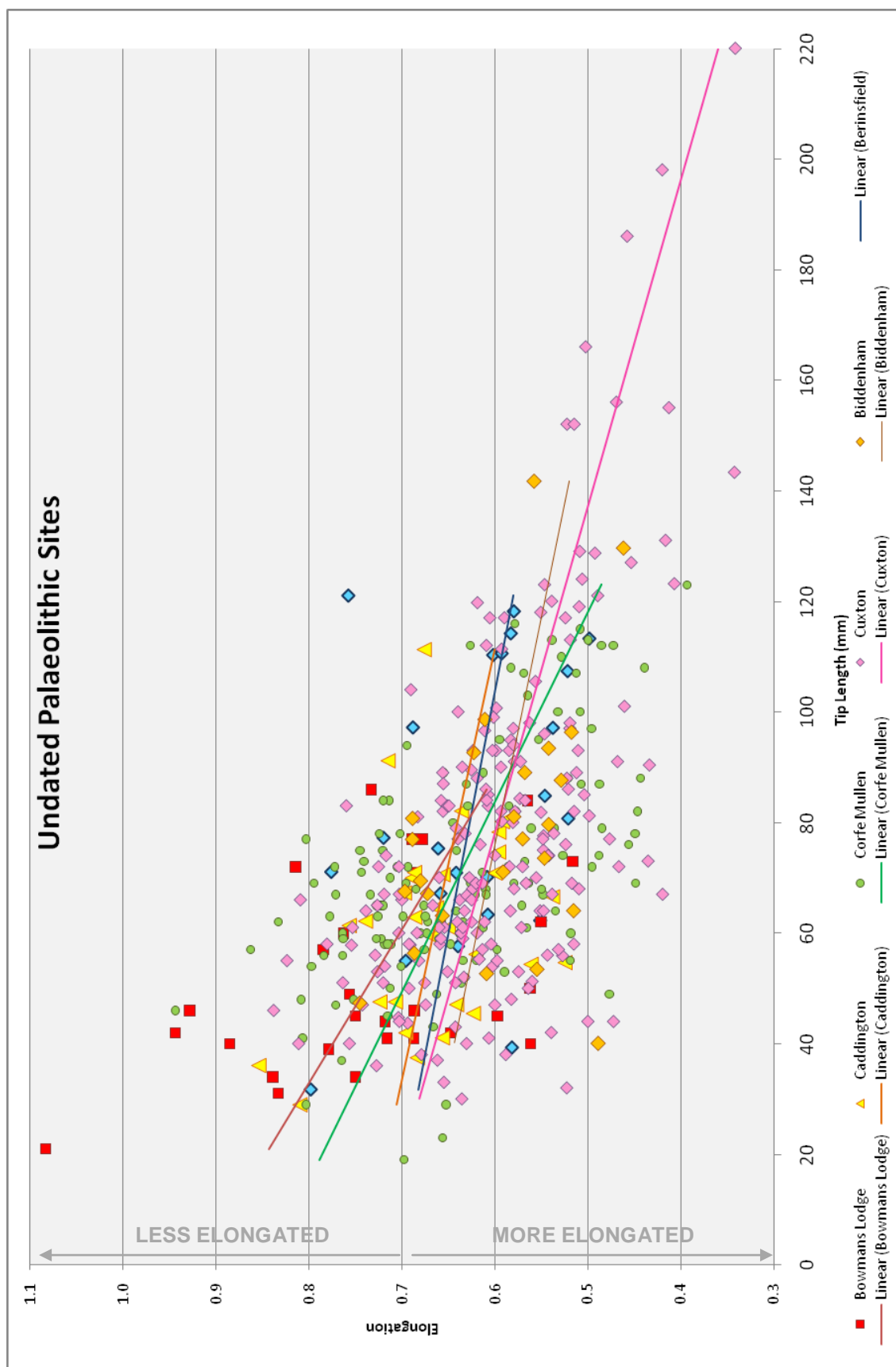


Figure 5. 20: Graph showing the ULP handaxes when TL is plotted against Elongation

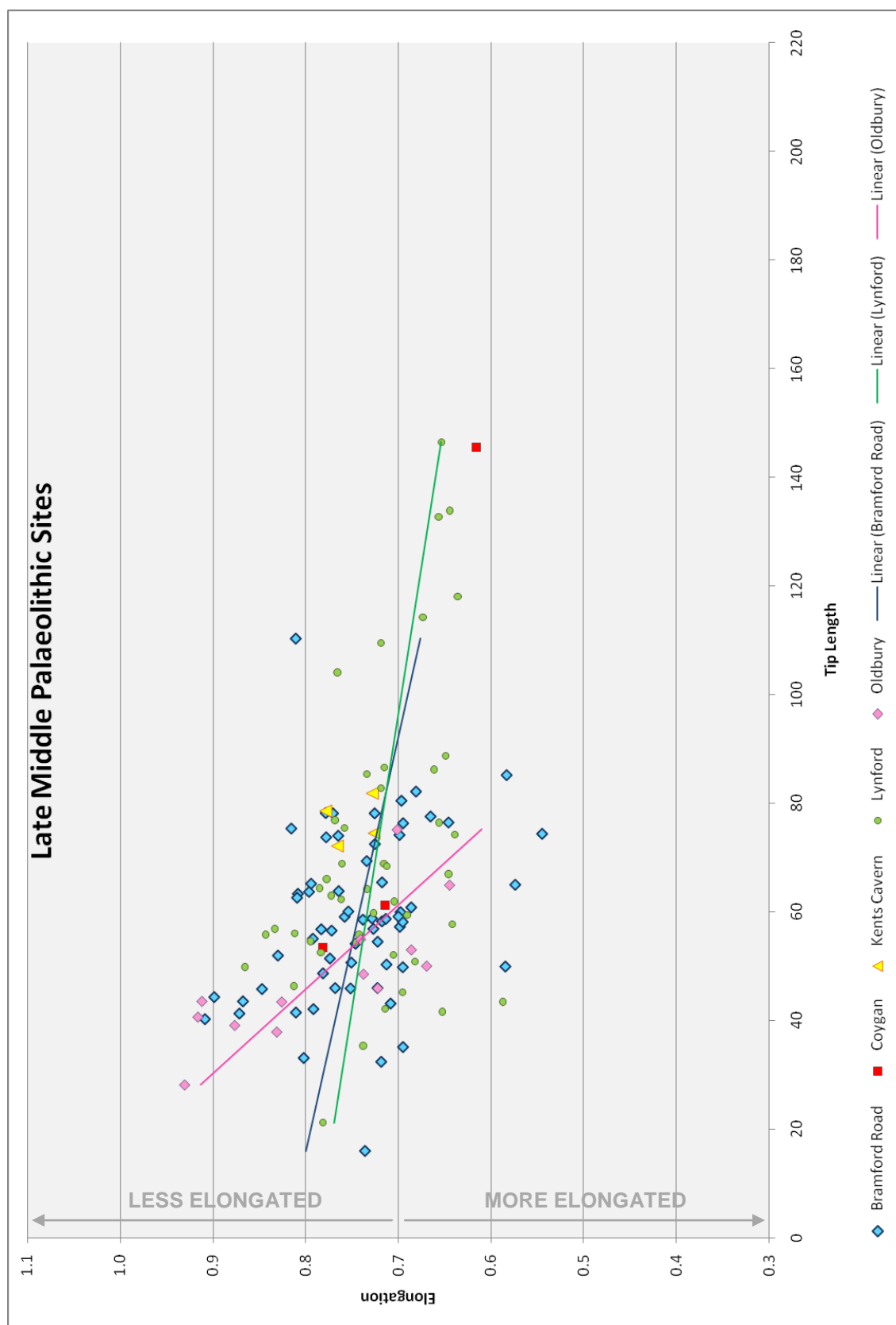


Figure 5. 21: Graph showing the LMP handaxes when TL is plotted against Elongation

The general picture presented by the Elongation Figures (5.17-5.21) is much less obvious than that of the Planform graphs. The points are more widely dispersed, and, although there is a general trend, it is not as clear cut as the Planform graphs. There does not appear to be a central clustered group either. I would suggest that this is likely to be due to the greater possibility of variation with Elongation compared to Planform. Although a handaxe can be made with any planform or elongation figure between 0 and 1, it is more likely that handaxes will vary more when comparing width to length than when comparing one measurement of length (L1) to length (L). The number of viable possibilities for the combination of width and length should also be greater.

Amalgamating the findings of the above analysis it has been possible to see that there is some patterning in variation with relation to elongation, particularly in the distribution of LMP and EMP sites. Boxgrove also appeared to assert itself as a unique site within its period and this will be examined further in a later section. The chronological patterning that made Mousterian sites distinct with regards to the median figure also warrants further examination. With reference to the resharpening hypothesis, it seems that the data does conform with McPherron's (1995) observations, and that within individual assemblages pointed handaxes are more elongated than ovates, although this is not demonstrable between sites. The question that again remains is whether or not this pattern in the data is indeed due to the resharpening of pointed handaxes into ovate ones.

ANALYSIS OF ELONGATION RESULTS

From the above results, McPherron's patterning of elongated, narrow points to broader ovates is roughly verified. However, a closer look at the underlying

reasoning behind the elongation measure reveals that it may be possible to duplicate McPherron’s (1995) expected pattern without the linear relationship caused by resharpening a point into an ovate. The measure of elongation is fairly straightforward. It gives a measure of whether a handaxe is long relative to its width or wide relative to its length:

Length (cm)	Width (cm)	Elongation Index
10	2.5	0.25
10	5	0.5
10	7.5	0.75
10	10	1.0

Table 5. 11: Sample Elongation figures

The figure is a measure of ‘narrowness’ and does not necessarily correspond to whether a handaxe is a point or an ovate, as either type can theoretically be elongated or not. However, due to the nature of the two types, ovates are less likely to be elongated because the point of maximum width is required to be further from the base. McPherron’s hypothesis (1995) would have an elongated point being reduced down through the reduction of the tip into an ovate that was relatively wider in proportion to its length. However, this pattern could be recreated artificially without using resharpening as a factor. An example of two handaxes that are the same length, one ovate and one point, is illustrated below:

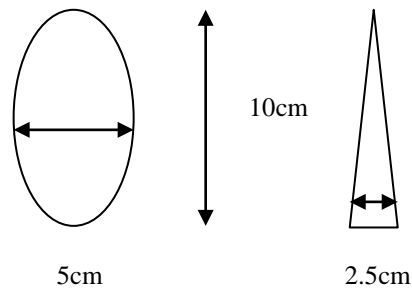


Figure 5. 22: Graphical demonstration of elongation in ovates and points

	Length (mm)	Tip Length (mm)	Planform	Width (mm)	Elongation Index
Ovate	100	50	0.50	50	0.5
Point	100	80	0.20	25	0.25

Table 5. 12: Summary of data required to produce elongation index for handaxes in Figure 5.22 (above).

Using Figure 5.22 as a guide, the relative widths mean that the Point is more elongated than the Ovate. However, in this example, it is clear that the point cannot possibly be reduced down into the ovate. Yet, looking at these two handaxes as plotted on Figure 5.23 (below) it is apparent that the patterning of handaxes with short tip lengths being less elongated than handaxes with long tip lengths (McPherron, 1995) can be recreated using the above examples. However, this patterning is completely unrelated to a chain of reduction from point to ovate. This renders the measurement void in terms of providing support to the theory that pointed handaxes are reduced down into ovate handaxes.

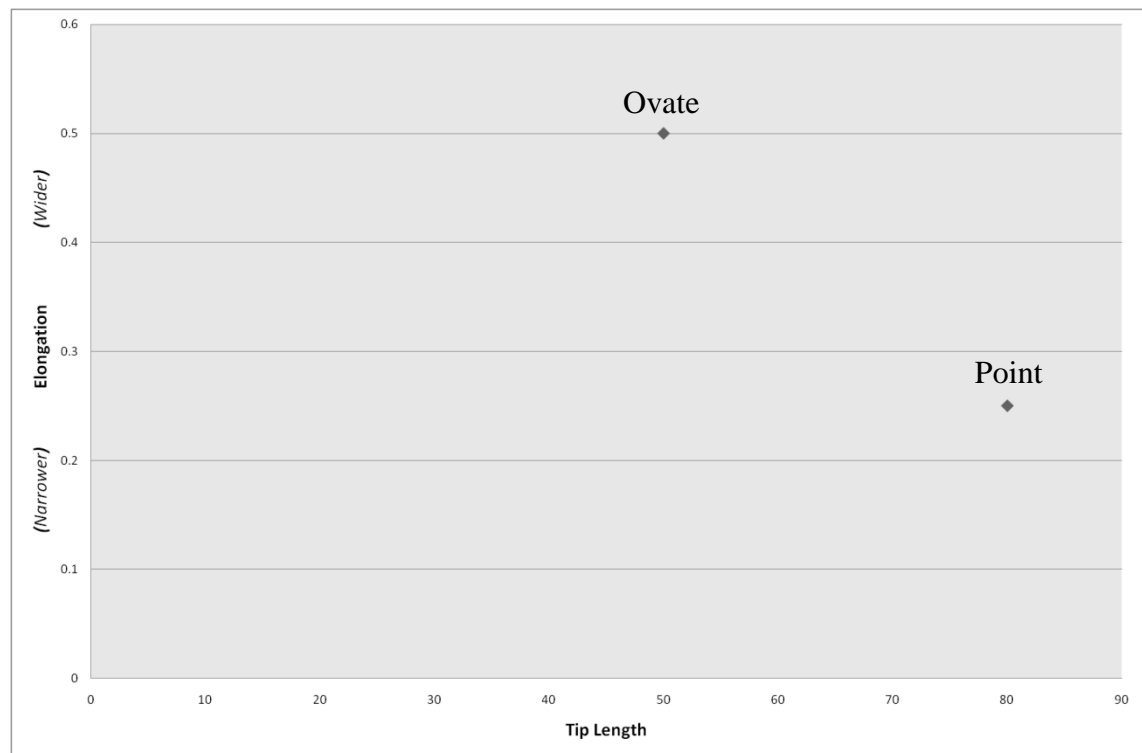


Figure 5. 23: Graphical representation of patterning that is produced using the handaxes from Figure 5.22.

5.4.3 REFINEMENT (TH/W)

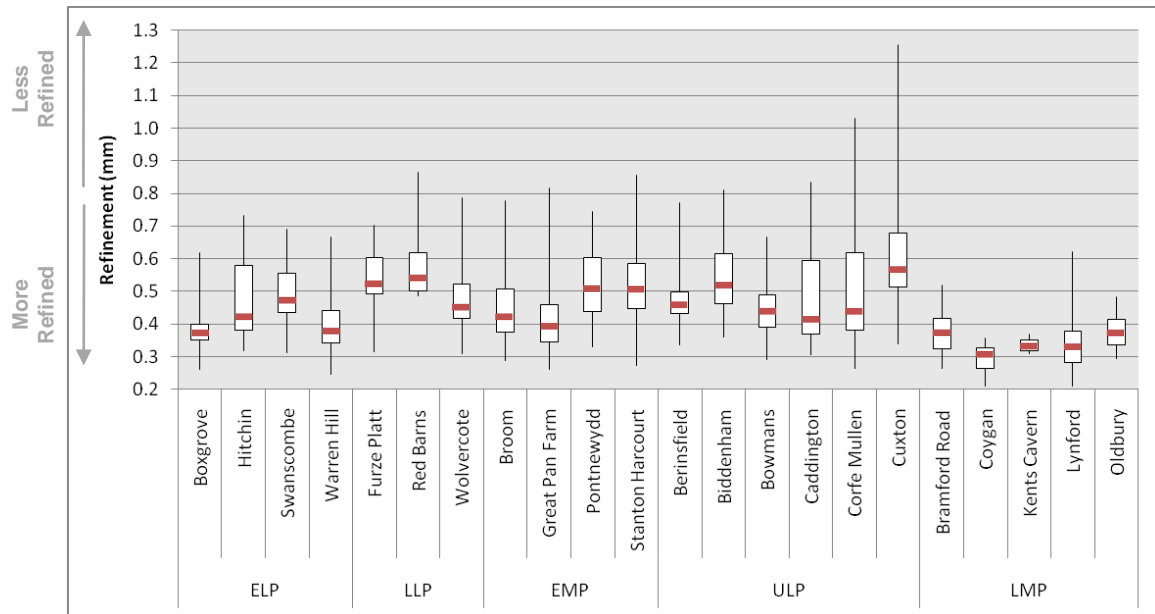


Figure 5. 24: Graph showing the median and high/low/range values for Refinement (sorted by period).

The third variable under scrutiny here is refinement – the relationship between width and thickness (Th/W). A refinement figure of 0.5 would represent a handaxe that has a thickness equal to half its width. Lower figures represent more refined handaxes that are thin relative to width. Figure 5.24 shows the variation present in refinement within each site, sorted by period. The pattern echoes that from previous variables, as the LMP handaxes stand apart as a group on their own, only rivalled by the unconstrained ovate handaxes of Boxgrove and Warren Hill in their high level (<0.4) of refinement. This is more obviously illustrated below, where the sites are sorted by median (Figure 5.25):

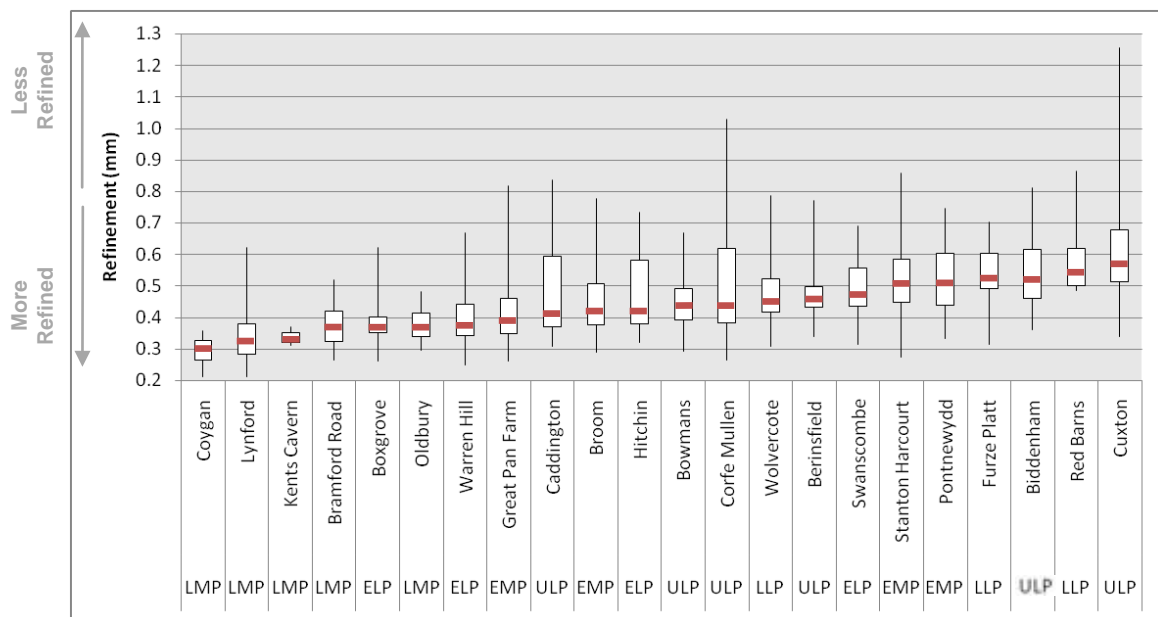


Figure 5. 25: Graph showing the median and high/low/range values for Refinement (sorted by median – ascending – lower refinement to the right).

In the case of refinement the LLP handaxes exhibit the opposite pattern to the LMP handaxes as, with the exception of Wolvercote, all fall in the less refined end of the graph. McPherron's (1995) theory is contradicted as the Mousterian sites are roughly characterised by pointed handaxes which have low levels of elongation and high levels of refinement in opposition to expectations. Cuxton, for reasons which will be explained below, is the least refined assemblage overall.

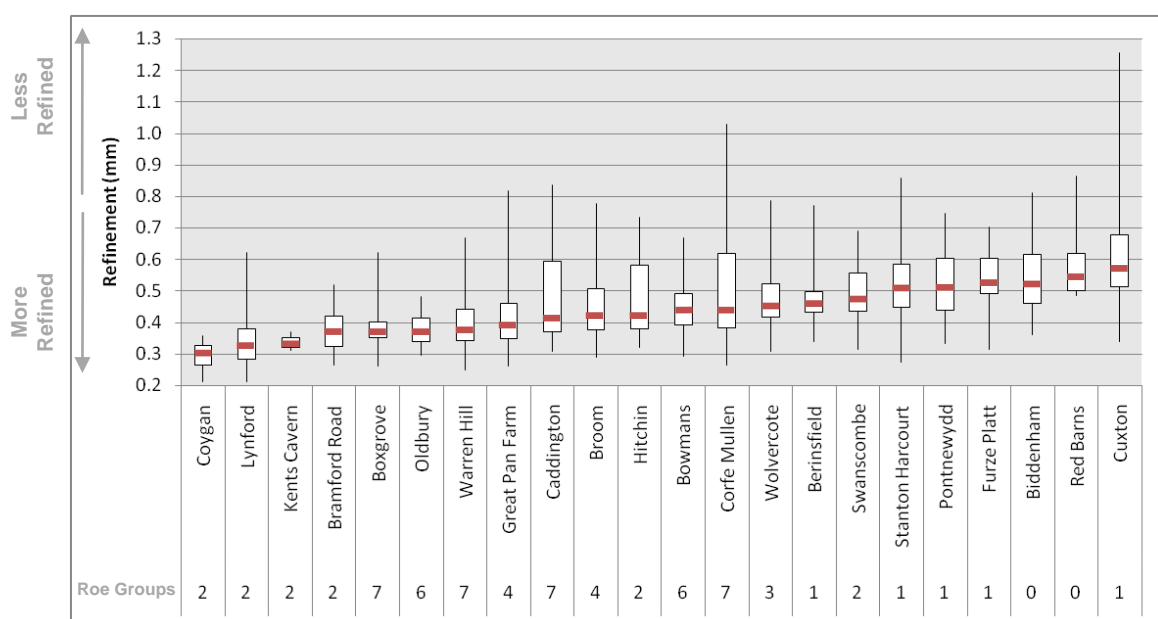


Figure 5. 26: Graph showing the median and high/low/range values for Refinement (sorted by median - ascending) Numbers refer to Roe (1968) groupings.

Figure 5.26 shows the sites sorted by median but the period names are changed to reflect the Roe Groupings assigned earlier in the chapter. There is a distinct trend showing the Mousterian Pointed Group 2s to the left and the Acheulean Pointed Group 1s to the right. In fact, with the exception of Hitchin, which is exceptional in its own right due to the presence of twisted ovates, the pointed groups are located at the least and most refined ends of the spectrum, with the LMP at one end and the ELP, EMP and LLP at the other end. The intermediate group and ovate groupings are distributed randomly in-between. When Roe (1968) separated Group 1 and 2, one of the criteria at the basis of the separation was that Group 1 forms were characteristically less refined than other groups. The pattern outlined above, separating pointed forms on the basis of period, echoes that found in Figure 5.15 which found differences in elongation along similar lines, with both Figures supporting Roe (1968).

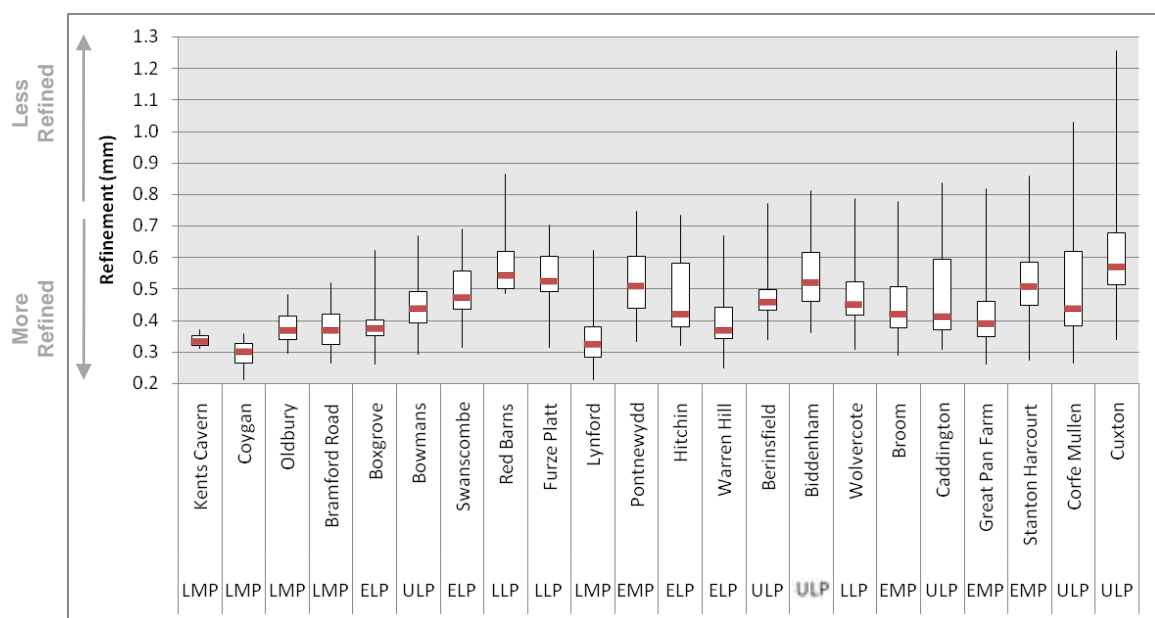


Figure 5.27 : Graph showing the median and high/low/range values for Refinement (sorted by overall range).

When the sites are sorted by overall range, it is noticeable that they are more clustered than previous measurements. With the exception of a small group of large

and small ranges, the majority cluster between overall ranges of 0.36 to 0.43. This may reflect a restriction posed by raw material and/or manufacturing techniques. The presence of the highly refined LMP assemblages does seem to reflect a different manufacturing mechanism to the other sites, which may be linked to more intensive forms of reduction (see Chapters 6/7).

This initial examination of Refinement variability within and between assemblages has produced some interesting insights, particularly in terms of the variability related to Acheulean/Mousterian. I will look at this again later in the chapter when the underlying assumptions of McPherron's (1995) hypothesis have been examined. Overall, it was to be expected that the Lynford and Boxgrove handaxes show a high level of refinement, as this is evident from a visual examination. The opposite is also evident at Cuxton as the handaxes are often characterised by a long, narrow profile with large, globular butts. Plotting each handaxe individually will allow for any patterns or extremes to be taken into account. The following is a recreation of the graphs produced by McPherron (1995) to ascertain whether the same patterns of thick handaxes with long tips and thin handaxes with short tips (and vice versa) can be observed.

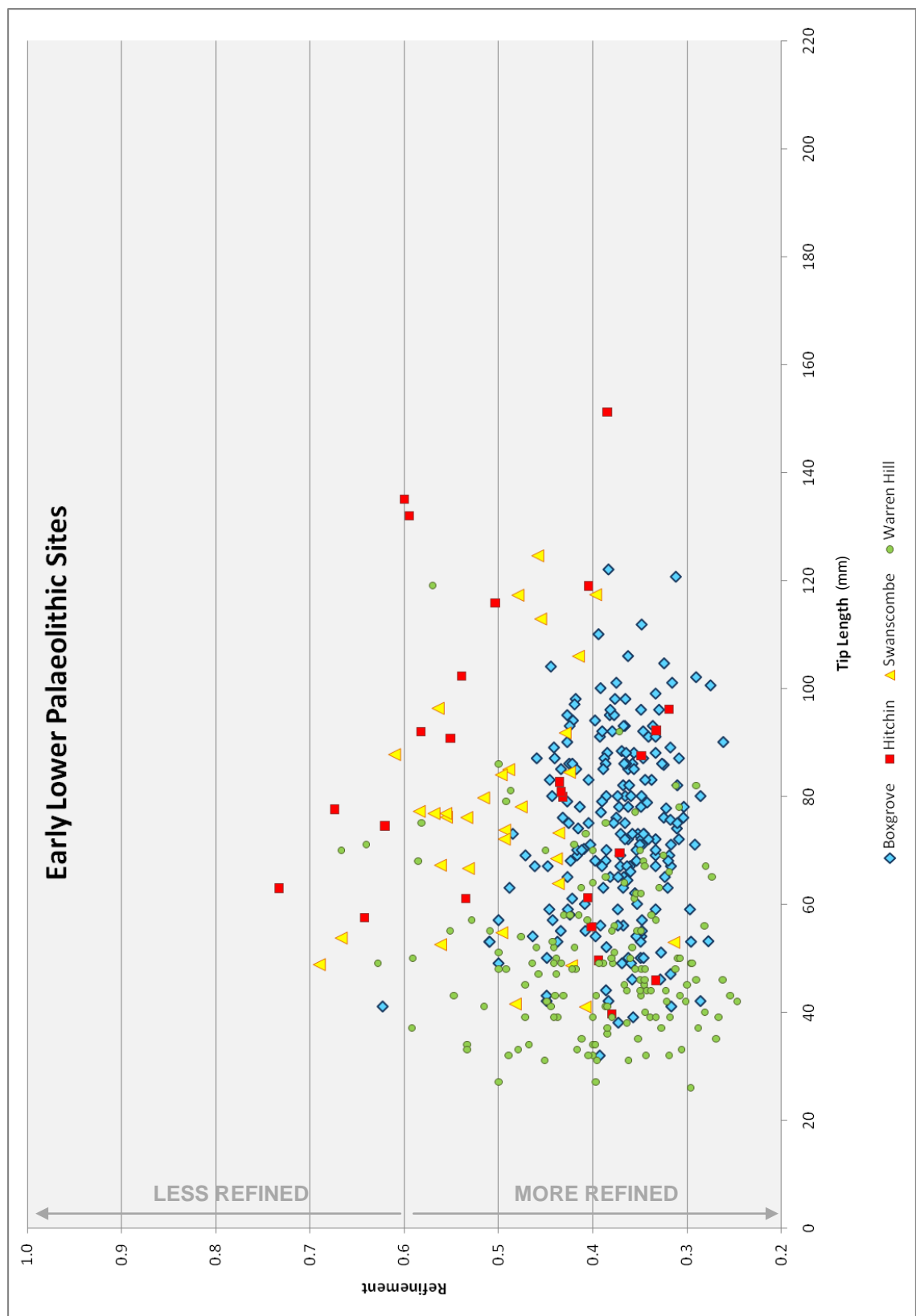


Figure 5. 28: Graph showing the ELP handaxes when TL is plotted against Refinement.

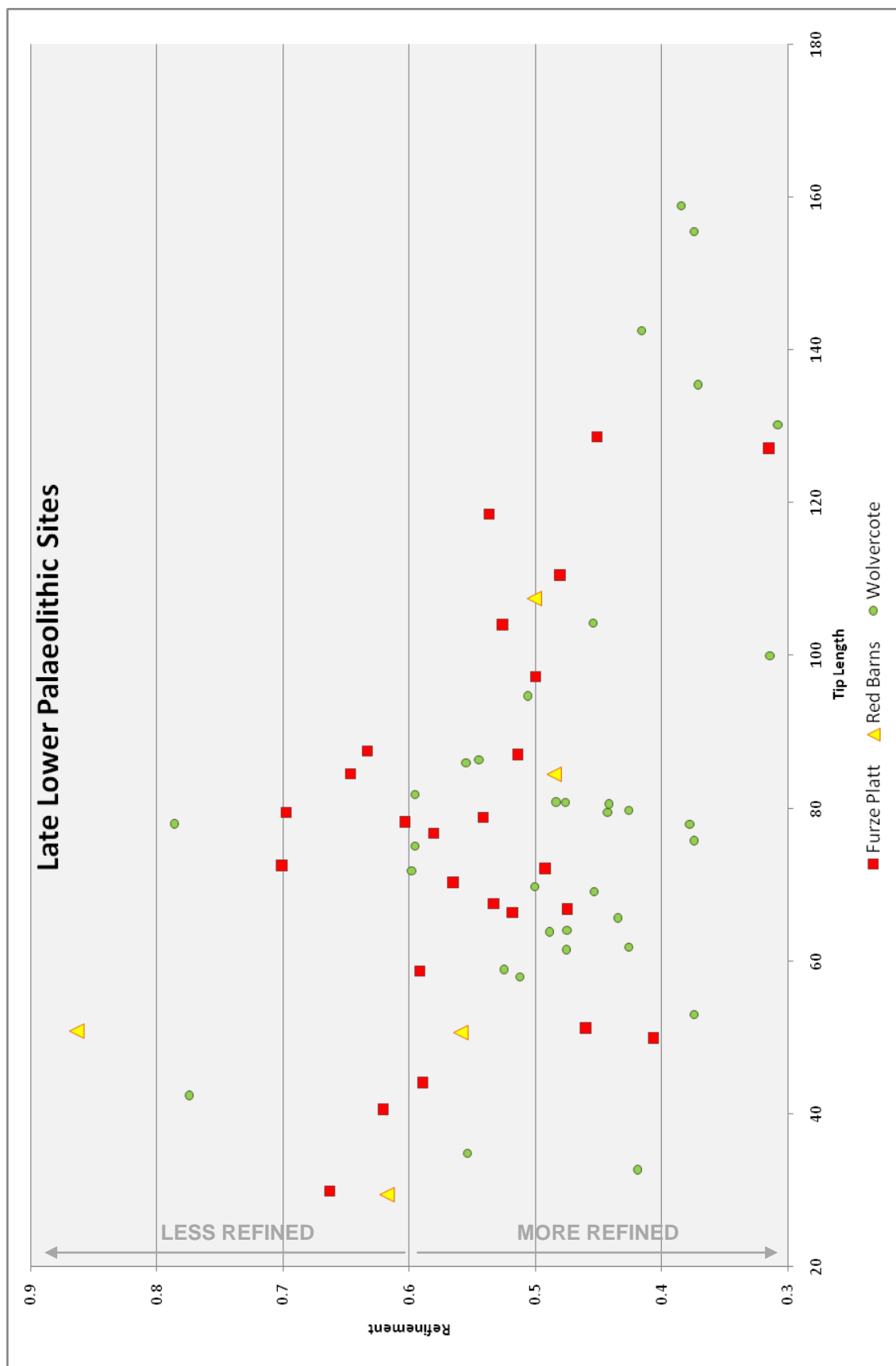


Figure 5. 29: Graph showing the LLP handaxes when TL is plotted against Refinement.

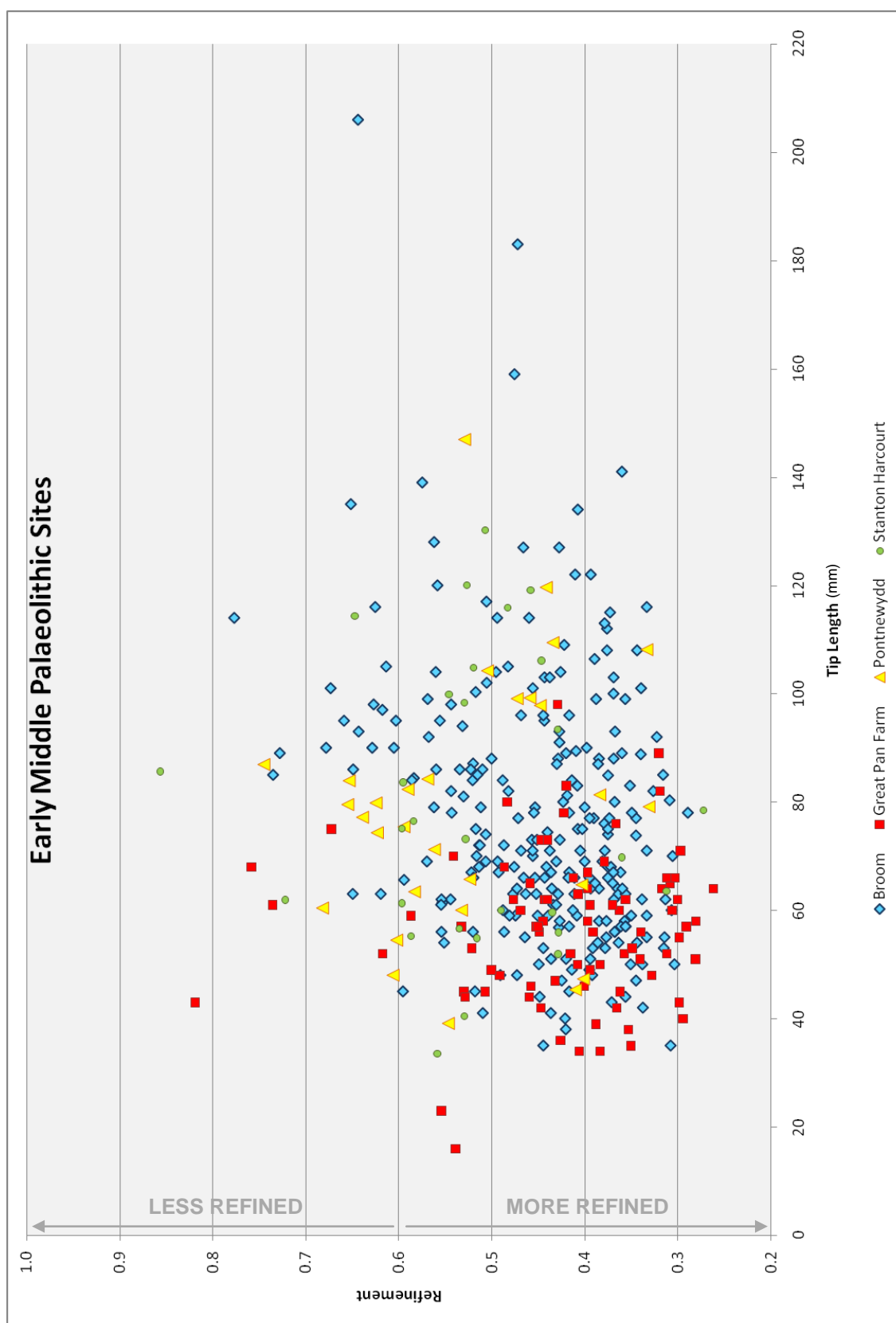


Figure 5. 30: Graph showing the EMP handaxes when TL is plotted against Refinement.

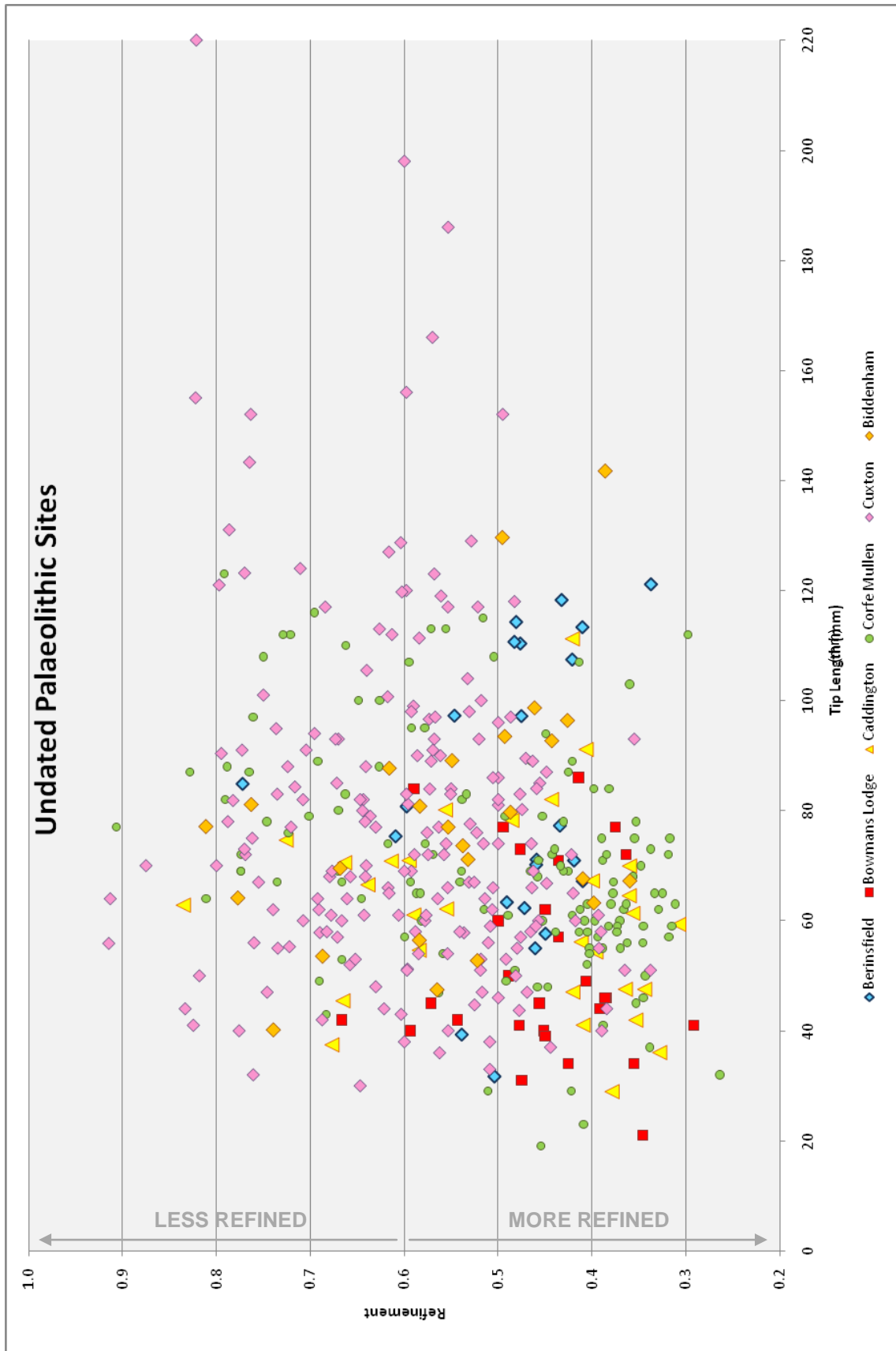


Figure 5. 31 : Graph showing the ULP handaxes when TL is plotted against Refinement.

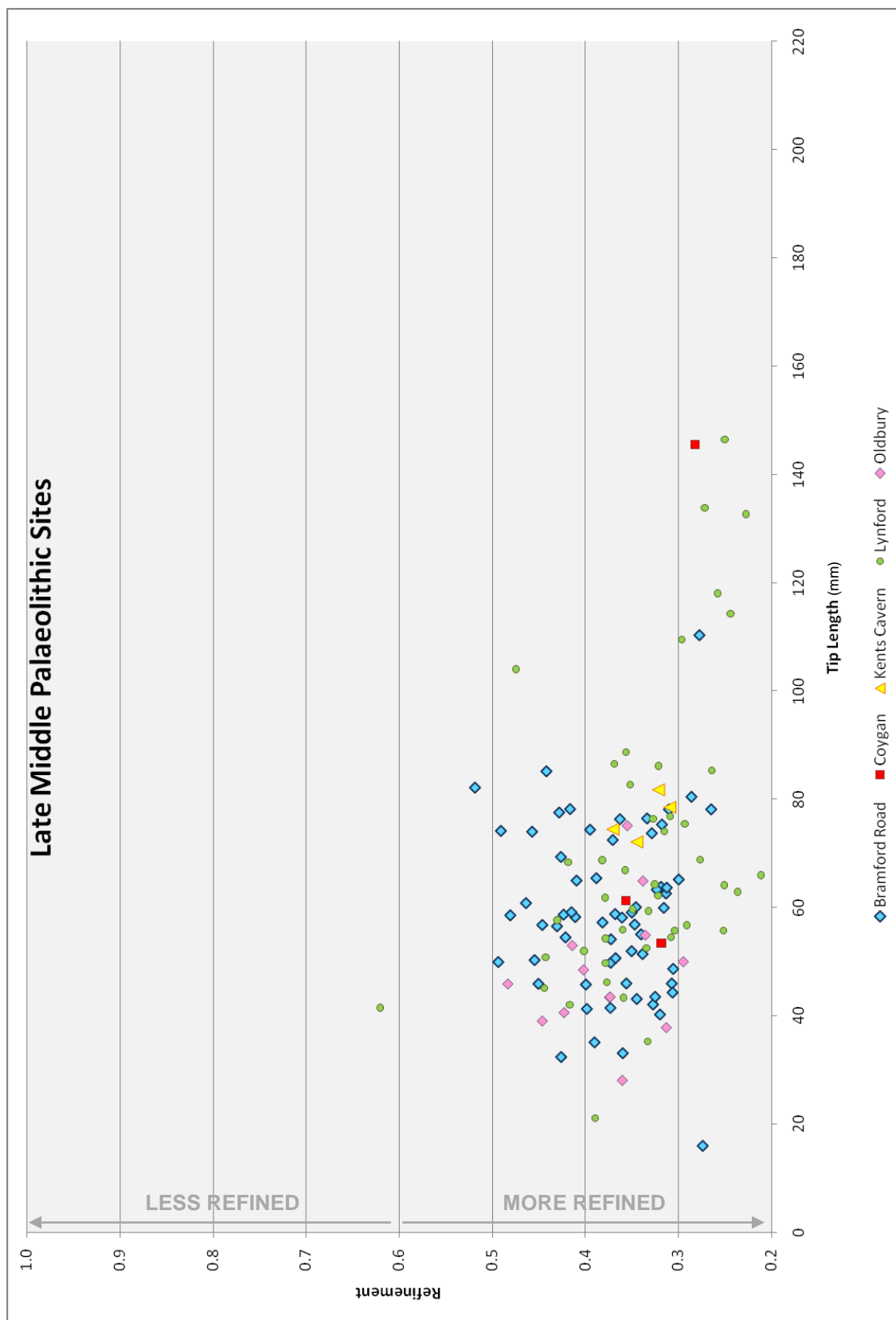


Figure 5. 32: Graph showing the LMP handaxes when TL is plotted against Refinement.

The refinement graphs (Figures 5.28-5.32) show the least amount of coherency and exhibit very little patterning. On each graph, some sites seem to cluster, others are dispersed. For example, in Figure 5.30 Great Pan Farm exhibits a central clustering, with some outliers, whilst Broom is much more dispersed. Few of the sites appear to illustrate a coherent linear pattern. In summary, individual handaxes plotted for Refinement against Tip Length exhibit a mixture of clustered (c.f. Boxgrove, Warren Hill, Great Pan Farm, Corfe Mullen) and dispersed (c.f. Swanscombe, Hitchin, Broom, Cuxton) patterns, with little perceivable coherency. This may to some extent reflect the variety of raw material quality/types utilised and should be examined further.

The results of the refinement analysis are mixed. A large disparity between pointed groupings which is seemingly related to the period in which they were produced may provide an insight into the difference between Acheulean and Mousterian handaxes. The results of the individual handaxe plots produced an incoherent distribution with little patterning. With reference to the resharpening hypothesis, it seems that the data does not conform to McPherron's (1995) observations and that within and between individual assemblages pointed or ovate handaxes can be refined or unrefined. The question remains as to whether McPherron (1995) should ever have used refinement as a measurement to prove that the resharpening of pointed handaxes into ovate ones was taking place.

ANALYSIS OF REFINEMENT RESULTS

From the above results, McPherron's (1995) patterning regarding refinement does not seem to be supported by the data. The patterning recorded by McPherron can be

further critiqued by the assertion is that it is based primarily on the measurement of maximum thickness which may not be indicative of the overall thickness of a handaxe. For example (see Figure 5.33, below), Handaxe A has a maximum thickness of 5cm and a width of 8cm (A1) (Refinement = 0.6) and Handaxe B has a maximum thickness of 3cm and a width of 8cm (B1) (Refinement = 0.4). Yet, the same refinement values are maintained even if Handaxe A had a tip width of only 1cm (A2), and Handaxe B was a constant 3cm (B2) as it is only the maximum width that is utilised. The question is, does this measure of refinement fail to provide an accurate indicator of the relative thickness of the handaxe? A good example of a handaxe with a refined tip and an unrefined butt comes from Cuxton (Figure 5.34), where a large number of the handaxes exhibit this shape.

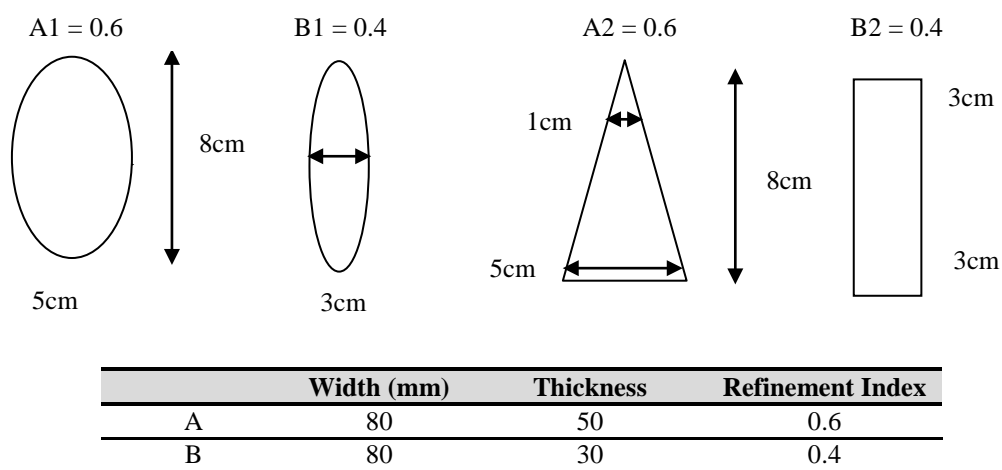


Figure 5. 33: Graphical representation of handaxes with different refinement values.



Figure 5. 34: Cuxton handaxe (93), side profile (Photo: KE).

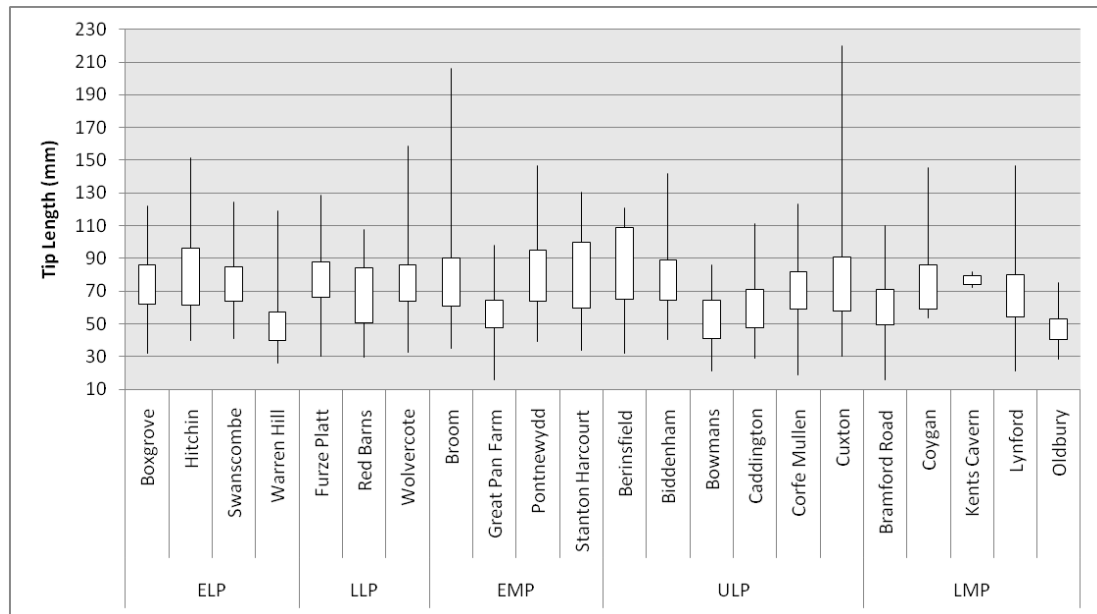


Figure 5. 35: Graph showing the median/high/low/overall range values for Tip Length.

Figure 5.35 shows the variation present within each assemblage with regards to Tip Length. It is not necessary to show any other sorting of this data as there is no patterning at all visible which would suggest that Tip Length is being affected by another factor. As with Elongation, it might be expected that the assemblages that were point-dominated would cluster to the right-hand side of the diagram as pointed handaxes are expected to have longer Tip Lengths. This is not the case, but may be due to differences in the available raw material size of each assemblage. Tip Length is clearly a measure which will show differentiation within assemblages, but not between them. What is most evident is that there is a large range of variation in a number of the assemblages.

This concludes the examination of the McPherron (1995) methodology and the discussion continues below with a summary of the key points of interest identified.

The preceding analysis has attempted to replicate McPherron's (1995) findings with regard to British handaxe-dominated assemblages and the key ratios of Planform, Elongation and Refinement. It has also identified some fundamental problems with the assumptions and methodology utilised by McPherron (1995). The problems inherent with McPherron's (1995) theory began to surface in Chapter 3 when doubt was cast on the validity of using the Point/Ovate division as a basis for explaining handaxe variability and has continued with an undermining of the idea that all raw material must be identical in size for the methodology to be effective. It has been demonstrated that the patterns produced by Planform and Elongation measures can be artificially produced and that Refinement may not give an accurate indication of the true shape of a handaxe. It is no longer possible to assume a continuum of reduction from Point to Ovate based on McPherron's (1995) theory. Certainly, it does not appear that the patterning advocated by McPherron (1995) is as definitive as presented, nor is the reasoning behind it satisfactory.

However, these issues only discount the patterning examined in the scatter graphs and by no means invalidate the site by site comparison conducted. In contrast, the present analysis has been successful in creating some interesting observations, particularly concerning the differences between Mousterian and Acheulean assemblages. The following is a summary of the main observations:

The main observation with regards to planform is that Lynford handaxes are more variable in terms of overall range than other LMP sites. A greater fluidity in manufacture may be indicated which is not tied distinctly to form. Alternatively, if McPherron's theory (1995) is used, Lynford may represent a site where handaxes are discarded in different stages of use-life, whereas the other LMP sites contain only handaxes in the early stages of resharpening. However, it has been suggested that the *bout coupé* handaxe form represents a highly resharpened form (Tyldesley, 1987): so therefore Oldbury, Coygan and Kent's Cavern may in fact contain handaxes at the end of their use-lives, nearly 100% tip. Therefore it becomes difficult to apply either White (1998a) or McPherron's (1995) theories to the Mousterian, where good quality raw material can be linked to sites dominated by pointed forms.

The only site more variable in planform than Lynford is Cuxton. The explanation in Cuxton's case is unlikely to be related to fluidity in tool form and is more likely to be connected to the unusual raw material utilised at the site. The intractable nature of pipe flint means that the choices for creating handaxes are highly conditioned by the raw material, leading to the creation of handaxes with highly refined elongated tips (Figure 5.34, above). Poor quality raw material has not led to a predominance of pointed handaxes (50%) but instead to a wide range of handaxe planforms where a mental template is seemingly unable to exist. The discussion will return to Cuxton in Chapter 7, where the concept that the handaxes from this site are culturally significant (Wenban-Smith, 2006) will be explored.

Interestingly, the above analysis indicated that variation in planform was not related to either raw material type or the dominant planform in the assemblage. The concept of a mental template (Ashton and McNabb, 1994) appeared somewhat undermined by the fact that the dominant type in most assemblages varied more than the numerically minor category, which was more restricted. Conversely, a more generalised template may have existed, regardless of planform grouping, which has led to a preferred range of between 0.20-0.50, within which 80-90% of handaxes fall. Whether this is due to a deliberate choice to maintain ratios of length and width, or a mechanical consequence of knapping, remains to be seen. Although there was some patterning in planform variation related to Roe's (1968) groupings, it was not significant enough to categorically define assemblages on this basis.

5.5.2 ELONGATION

The main observation with regards to elongation was the contrast between LMP and EMP sites, with the former being the least variable. LMP sites again showed a consistency in median values, confirming the assertions of Collins and Collins (1970), that Mousterian handaxes are, on average, less elongated than their Acheulean counterparts. McPherron (1995) would contend that this is due to their representing more heavily resharpened components, giving more support to the notion that *bout coupés* are resharpened forms in the pointed range of planform. However, there was no link between the mean level of elongation in each assemblage and its overall range, nor a relationship between elongation and raw material. The only trend was for the larger assemblage groups to show more variation in elongation figures than the smaller groups, with the exception of Boxgrove. Roe's groupings

were somewhat vindicated within the Pointed groupings (I and II) which divided in terms of period.

5.5.3 REFINEMENT

The main observation with regards to refinement is that again the LMP sites form a group on their own, representing very refined handaxes on average. This is only matched by the fine handaxes at Boxgrove and Warren Hill, where raw material is easily available. In the case of refinement, it is the LLP sites which appear to show less refinement. Roe's Pointed groupings (I and II) divided again in terms of period. Overall, there is less variation in refinement values than other ratios, which may reflect mechanical constraints in the range of variation it is possible to create. Any in-depth analysis of handaxes in terms of refinement is dramatically hindered by the lack of precision afforded by refinement as it is entirely based on maximum width.

5.5.4 CHRONOLOGICAL VARIATION

The main point of interest to emerge from the above analysis was the division between Acheulean and Mousterian sites in the measures of elongation and refinement (with the exception of Boxgrove). Overall, the Mousterian sites (LMP) demonstrated a consistency in median values within the group that was not matched in the other periods. The LMP demonstrated a dominance of pointed forms which measured alongside low elongation and high refinement. In contrast the ELP and LLP handaxes demonstrated higher elongation and lower refinement. The EMP handaxes showed less obvious patterning, with wide variation in planform and elongation, with lesser refinement. Overall, planform and refinement showed less

variation than elongation, with tip length and refinement showing no patterning. The analysis conducted above indicated that handaxes in the LMP were quantitatively different from their predecessors at assemblage level. Looking at the assemblages on a technological level, Acheulean versus Mousterian, the picture remains similar:

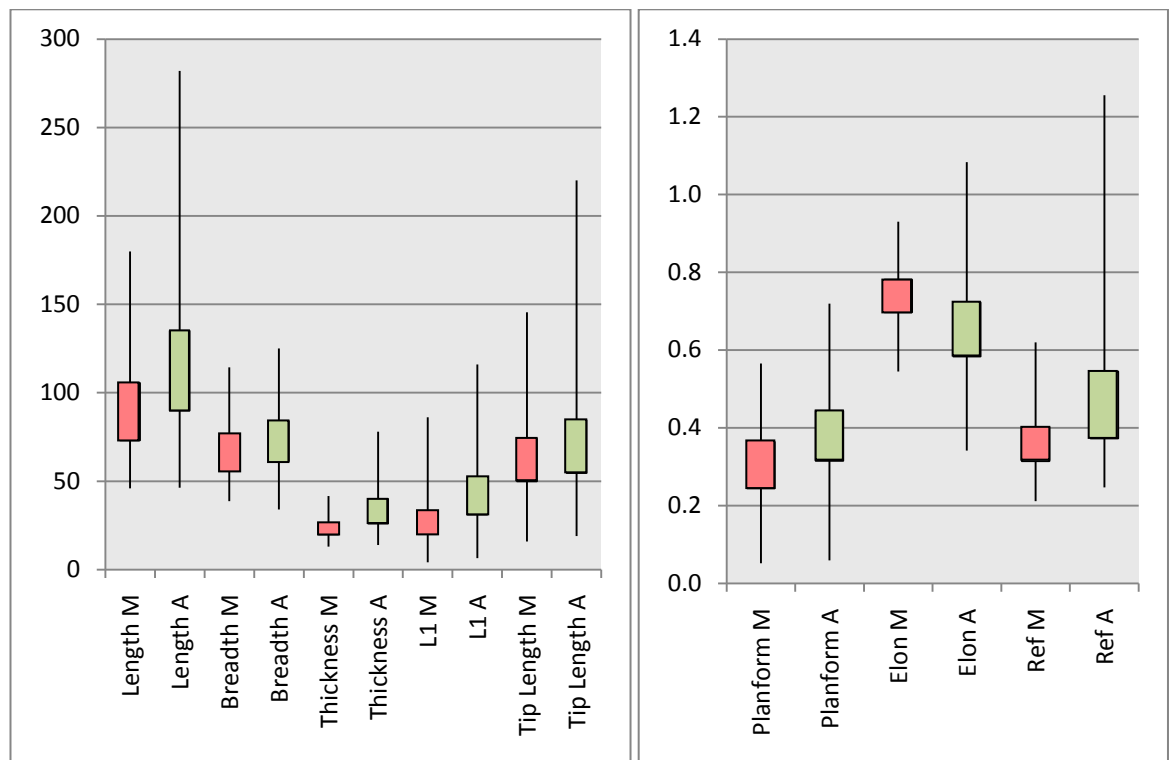


Figure 5.36: Metrical comparison of Mousterian and Acheulean handaxes. Sample size (M=128, A=1291)

In Figure 5.36, Mousterian handaxes (red) show less variation than the Acheulean handaxes (green) in all measures presented above. It must be noted that the Acheulean sample is 10x larger than the Mousterian sample. Interestingly, the low range of the bars tends to be similar in each pairing, with the Acheulean handaxes showing a higher mean and a longer range above the mean than below. The exception to this is elongation where the Mousterian group shows less variation on both sides of the mean but has a higher mean indicating less elongated forms. At face value, this would seem to confirm the earlier conclusion that Mousterian handaxes are

quantitatively different to Acheulean ones. However, the phrase ‘with the exception of Boxgrove’ was used more than once in the analysis above which led me to compare the handaxes from Boxgrove (n=201) with those from Lynford (n=44). I chose Lynford as the most comparable site to Boxgrove, as it also contains handaxes made from comparatively good quality raw material. The results of this comparison are shown below:

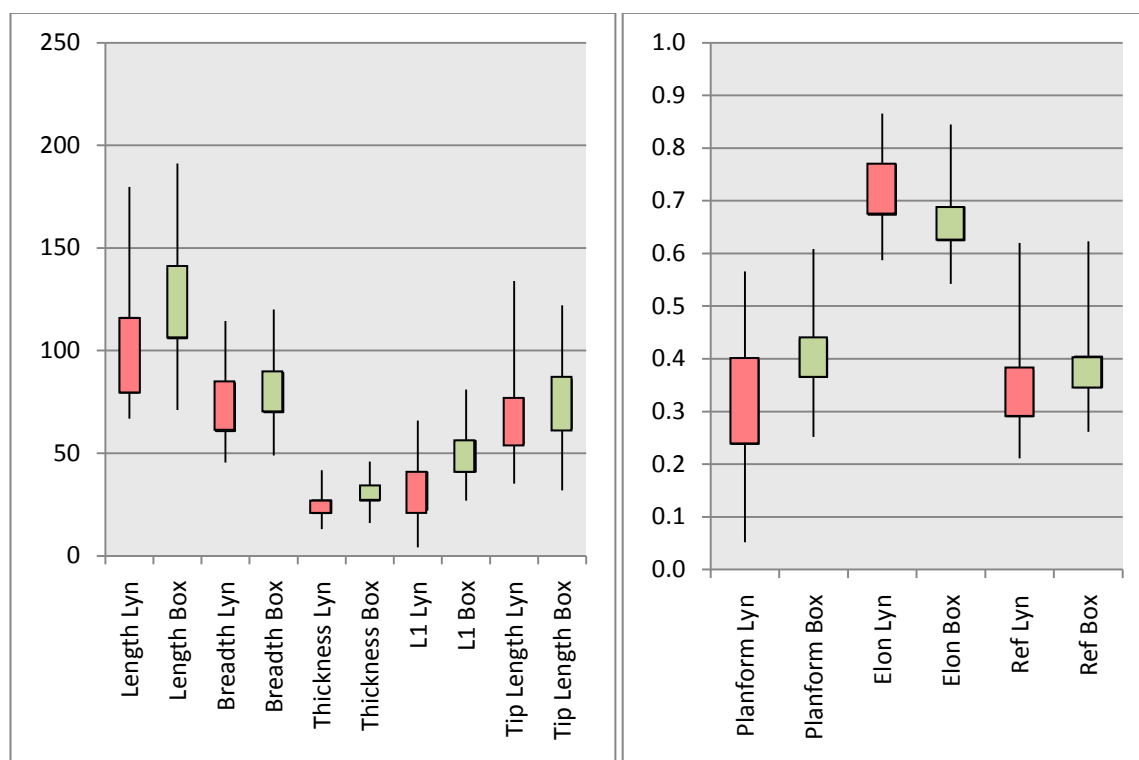


Figure 5.37: Metrical comparison of Lynford and Boxgrove handaxes.

The picture here (Figure 5.37) is far removed from that in Figure 5.36. Although the pattern of mean values is identical, the ranges represented in each measure are overall very similar and in a number of measures the range for Lynford (red) is greater than that of Boxgrove (green). The metrical analysis suggests that, at assemblage level, the handaxes are on average fairly similar to each other in many of these traditional measures. In the case of Boxgrove and Lynford, access to good quality raw materials is a unifying factor which allows for thin, elongated handaxes to be manufactured. The only significant difference metrically is the average and range of planform

values represented. White's (1998a) model predicts that both sites should be dominated by ovate handaxes, which is certainly the case for Boxgrove, however at Lynford pointed handaxes outnumber ovates two to one. McPherron (1995) would see these handaxes as representing an early stage in the manufacturing process, although White's (*in prep*) analysis of Lynford handaxes suggests some evidence for resharpening and recycling of handaxes so McPherron's (1995) position would seem to be incorrect. In fairness, neither White (1998a) nor McPherron (1995) designed their models with Mousterian handaxes in mind. However, it remains to be demonstrated as to why neither of their theories can be applied successfully to the handaxes at Lynford.

Clearly, this is an important first step towards answering the question: Does the superficial similarity of handaxes from 500,000 BP to 40,000 BP mask underlying and significant differences? The immediate answer is yes, certainly there appears to be some variation in these ratios that is bimodal between British Acheulean and Mousterian handaxes, perhaps indicating a different approach to handaxe manufacture and use in the British Middle Palaeolithic as posited by White (*in prep*). However, when two assemblages with similar raw material availability are compared the picture presented is less absolute. The overall metrical similarity of handaxes at Lynford and Boxgrove relates more to raw material than chronological positioning, indicating a similarity in response to good raw material sources. It is still probable though that the overall similarity in metrical measures is masking conceptual and functional differences. The next step in answering this question is to look at the factors influencing variation, including a more in depth consideration of raw materials, functional applications and mobility issues. Whilst not wholly within the scope of this thesis, it does represent an avenue of future investigation.

With regard to individual sites, Boxgrove stands out as a site which does not conform to expectations, either in the case of elongation, where it was separated from its most similar analogue Warren Hill and had one of the smallest interquartile ranges indicating restricted variation, or in the case of refinement, where it rivalled the high refinement values of the LMP handaxes. Further study is warranted into the factors influencing the manufacture at Boxgrove compared to the other ELP sites.

5.6

CONCLUSION

The results of the analysis in Chapter 5 have mixed consequences for the consideration of resharpening as the primary cause of variation. Previous critiques of the McPherron hypothesis (White, 1995, Ashton and White, 2003) have been demonstrated to have good grounding and it is difficult to see a way of amalgamating them into the reduction theory. These critiques can be supplemented by the other problems outlined above concerning constant raw material size, artificial patterning and imprecise ratios. It seems likely that the reduction hypothesis, whilst possibly still applicable to continental assemblages, cannot be used to explain the point/ovate patterning in the British dataset as it simply cannot be demonstrated that pointed handaxes are reduced into ovate handaxes for the reasons outlined above. However, there are undoubtedly patterns in the data which allude to a continuum of form related to tip length. If this relationship can be quantified without relation to the embedded concepts of 'Ovate' and 'Point' it may be possible to resurrect resharpening as an important variable in the consideration of the causes of handaxe variability.

The above discussion illustrates the problems involved when using published data with limited knowledge of the actual artefacts as McPherron (1995) did. Although secondary data is always a component of analyses, it should not be the entirety. The central problem with most of the theories concerning the explanation of handaxe patterning is that they seem determined to restrict the variability of British Palaeolithic assemblages to a dichotomous relationship between two types of handaxes which are based on an arbitrary division. There are few problems with assigning arbitrary values to create a typological division between different artefacts, and it is often helpful to be able to compare differing proportions of handaxe types as a basic measure of variation between assemblages. Yet, it does not seem to be advisable to attempt to draw inferences from these arbitrary categories without considering exactly what the measures and variables represent. From the above analysis, it appears that some of the variables used by McPherron (1995) do not even reflect variation within a single handaxe, let alone within an entire dataset. If anything is evident from the data presented above, it is that there is a large amount of variability both within and between assemblages that cannot be explained away by a simplistic division based on the relative location of the maximum width. It may still be possible to make general statements concerning larger patterns of variability between assemblages, but this should not be relied upon as a means to blithely ignore small scale adaptations to local conditions which, ultimately, provide the greatest insight into hominin behaviour (Gamble and Porr, 2005).

Overall, the salient points of the above discussion indicate that there are pitfalls involved when trying to condense variability down into meaningful categories and subsequently relying on these categories as the basis of interpretation. Certainly it appears that the patterning within British handaxe-dominated assemblages is more

adequately explained at a broad level by the Raw Material Hypothesis (Ashton and McNabb, 1994; White, 1995) than the Resharpening Hypothesis (McPherron, 1994; 1995; 1999; 2000). This would see raw material size, shape and quality as the primary factors influencing the form of handaxes at an assemblage level, leading to bimodality in British handaxe-dominated assemblages along point/ovate lines. Yet it would be unwise to simply attribute all variation to the supply and quality of raw material sources, relying entirely on another researcher's methods and data. This is especially true as there is patterning in the data that cannot be explained by the Raw Material Hypothesis (White, 1998a). Most especially, given that planform variability has been demonstrated in Chapter 3 to be representative only of the relative dimensions of the handaxe butt and tip, why do handaxes made on poor quality raw material have longer tips (relative to butts) than ovate handaxes? From my research, it appears evident that the best approaches to bifacial variability (c.f. Soressi and Hays, 2003) utilise a multi-modal synthesis of analytical techniques that incorporate a variety of methods. To this end, a new methodology for recording and interpreting handaxe variability is outlined in Chapter 6, with the aim of avoiding some of the pitfalls encountered above.



CHAPTER SIX – EDGE-SHARPENING: A METHODOLOGY

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The results of the analysis of McPherron's (1995) resharpening hypothesis, as examined in Chapter 5, indicated that there was little to support the assertion that pointed handaxes were being reduced into ovate handaxes through resharpening. However, this analysis also indicated the possibility of a continuum of resharpening focussed on the handaxe tip, echoing the extended chaîne opératoire suggested by Shott (1989; 1996) in his use-life concept. The exact nature of the resharpening trajectories that result in distinctive handaxe forms is not clear, and it is the purpose of this chapter to begin to examine these trajectories.

The implication of extended use-life and multiple resharpening episodes is that the form in which a handaxe is discarded may have undergone several changes since it was first created, which in turn may obscure evidence for a mental template conditioning the initial form of handaxes (Ashton and McNabb, 1994). Seeing the relationship between resharpening and form in this way does not deny that resharpening is a continuous mitigation between creating a usable edge whilst maintaining a balance in form and function. Undoubtedly the creation and recycling of handaxes represents a constant dialogue between knapper, raw material constraints and stylistic and functional priorities. Identifying the differential impact of these factors is key to understanding the variability present within British Palaeolithic handaxe-dominated assemblages.

The previous chapter recognised the need for the creation of a different methodology to elucidate the perceived variability both within and between handaxe-dominated assemblages. With this in mind, Chapter 6 presents a technique for measuring and

categorising edge variability. The decision to focus on handaxe edges was based on the assumption that the edge would be most impacted by the process of resharpening, and therefore that handaxe edges should preserve evidence of differential and compartmentalised reduction. Using the edges of the tools as a method for examining variability was chosen both as a means of creating distinct categories into which tools could be placed, and also to provide the scope for further interpretation. From this, it should be possible to make inferences regarding the type of manufacturing methods that are observable, the reasoning behind the choice of a particular strategy and the differing percentages of edge types and their implications for the division of handaxe-dominated assemblages. These points are covered in more detail below, but firstly, the existing literature on edge patterning is reviewed.

6.2 EDGE-PATTERNING STUDIES

The use of edges to categorise and define handaxes is not unique to my methodology and, although the method outlined below was not developed directly from the following research, it is useful to examine the ways in which edge variability is currently being used as a research tool and any problems inherent in its application. The major contributors in this line of research at present are McNabb *et al* (2004) and Soressi and Hays (2003).

McNabb *et al* (2004) split South African handaxes into twelve different zones (six on each face) and measured the extent of secondary working and edge trimming using ordinal scales to score the percentage of reduction in each zone. They then combined the data with other measurements of symmetry and tip shape to produce inferences about the nature of hominin manufacturing behaviour. The paper was substantially

criticised (McNabb, Comments, 2004) for making too large a leap between data and inferences, and suffers much from an over-complexity in the methodological approach.

As outlined in Chapter 2, Soressi and Hays (2003) used the edge as a means of accessing hominin manufacturing methods. They did this by examining the bifacial edge of the La Grotte (France) handaxes and combining this with usewear analysis. The result of this was that they could identify distinct episodes in the use and reuse of the tool as it underwent several stages of resharpening after use. The research itself provides a fascinating insight into the use-life of individual handaxes, yet has limited application to British handaxes due to the lack of good usewear traces.

6.3

MEASURING EDGE VARIABILITY

The first stage in developing a methodology for use in my research was to define the parameters within which the edge types could be recorded and categorised. The bifacial edge is the part of the tool that conceivably holds most information about the way a tool is manufactured and used. From the overview of other current methods, it is clear that a large amount of data can be obtained by careful study of the edge, beyond aspects of morphology. The aim of the edge variability study is to identify and categorise different types of edges based on the way a handaxe has been worked.

There are several types of data that can be recorded. Firstly, the intensity of edge reduction can be quantified by recording the number of scars on each edge, measuring them and comparing this to the overall dimensions of the handaxe as well as the average size of the removals. Jones (1979) provides a note of caution in this

respect by noting differences in the intensity of initial shaping and resharpening can be linked to raw material and this will be kept in mind throughout the analysis. Secondly, it is possible to record the amount of edge that retains cortex to provide an indicator of reduction intensity. Thirdly, the location and type of any unusual features such as tranchet removals and notches can be recorded. Finally, it should be possible to identify whether edges were being differentially worked within one handaxe, by comparing the total number of scars on each edge and also by identifying 'zones' of intensive working. These zones can then be used to create categories of patterning based on different combinations of edge use. These different categories can be compared to identify if there are any unifying variables that make each category distinct from the other, and to assess the differential combinations of manufacturing strategies employed within an assemblage. The overall aim of the methodology is to provide a new approach to categorising and interpreting handaxe variability within and between assemblages regardless of the age and context of the site.

The approach to recording this variability has been created with simplicity in mind. Each handaxe is artificially divided into four segments. Each of the two faces of a handaxe are divided into two halves (see Figures 6.1 and 6.2 below). The number and size of the scars that intersect directly with the edge are recorded for each half in turn, from base to tip, beginning with the base of the right half of the first face (A) and finishing at the tip of the left half of the opposite face (D). This means that edges A+C are both right hand edges whilst A+D are different faces of the same edge (and vice-versa)

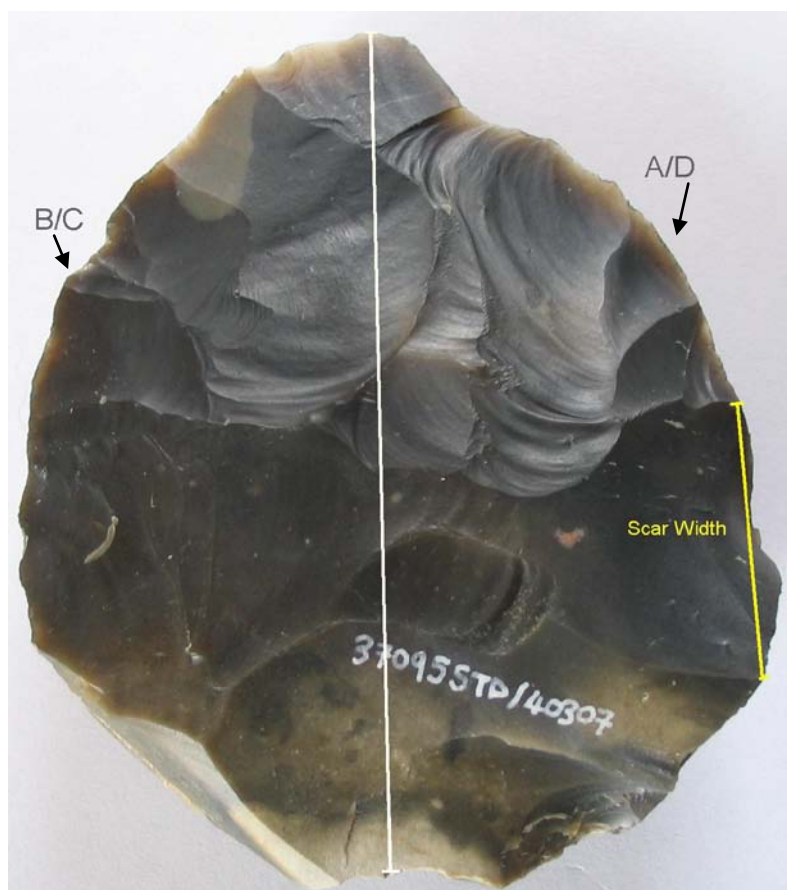


Figure 6. 1: Illustration of the measurements and labels used when recording the edges (Photo: KE)

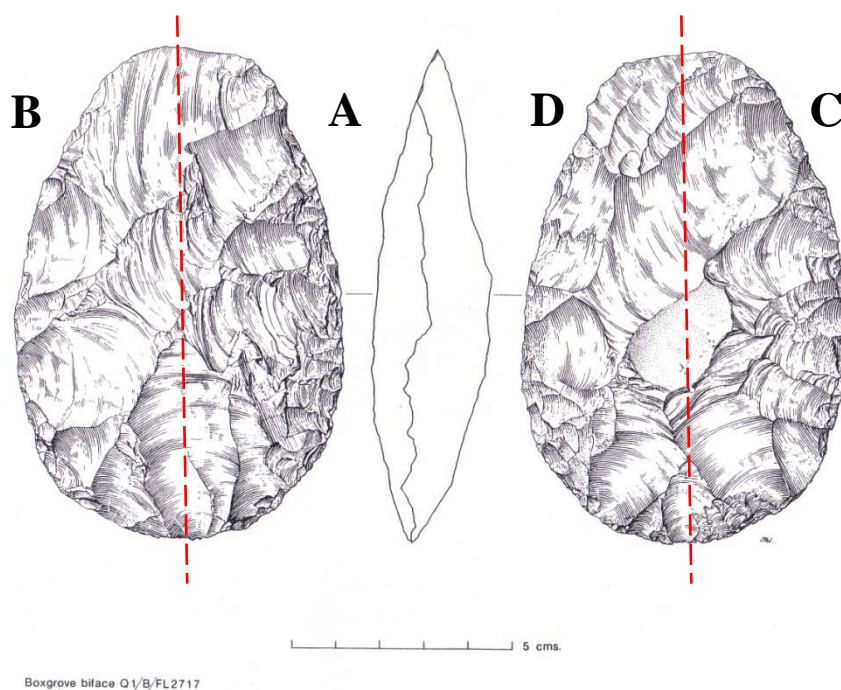


Figure 6. 2: Diagram showing the location of each edge (Image courtesy of M.Pope, Boxgrove Project).

Table 6.1 is a sample of the recording format for one handaxe, in this case one of the Lynford handaxes. The number and context of each handaxe is recorded, the width of each edge scar recorded down the columns, with each row recorded down the columns, with each row representing a separate edge. Features such as any cortex retention or notches are recorded by using **bold** and underline respectively.

Handaxe No	40199	40199	40199	40199
Context	20254	20254	20254	20254
Site	Lynford	Lynford	Lynford	Lynford
Edge	A	B	C	D
	3.93	11.15	<u>40.52</u>	72.94
	4.01	2.29	6.58	3.77
	3.64	6.48	9.66	2.76
	14.9	4.8	6.74	
	1.26	5.69	2.05	
	4.22	3.48	1.34	
	3.16	1.77	3.92	
	4.04	12.41	1.75	
	3.08	7.69	2.84	
	6.06	3.09	8.03	
	2.41	10.95	2.75	
	3.97	8.57	1.79	
	4.95	2.07	9.08	
	2.96	2.12	21.98	
	2.95	2.65	14.34	
	2.54	3.26	4.94	
	4.67		4.4	
	3.5		4.4	

Table 6. 1: Example of recording system

These measurements were initially converted into a percentage of the total length and then plotted cumulatively in graphs, from which visual conclusions were drawn as to any preferential working or patterning (Figure 6.3). Edges on the same face are indicated by the same colour, edges on the same side by the marker.

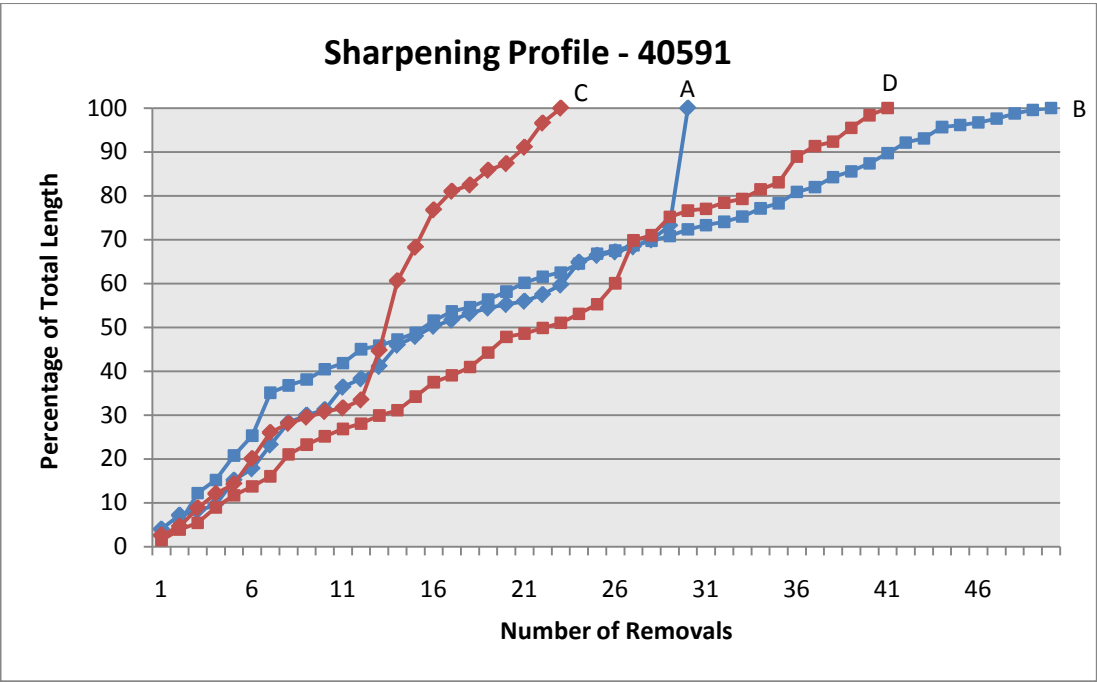


Figure 6. 3: An example of one of the graphs produced by comparing the number of removals and the percentage of the total length of each removal. The handaxe is 40591 (Lynford).

6.3.1 EDGE PATTERNING

It became apparent during the formulation of my methodology, that there were several possible approaches to edge manufacture and so I formulated a set of different combinations of edge working. The relative proportions of these combinations found in an assemblage form the basis of any analysis of edge patterning within and between assemblages. The combinations are as follows:

FACE-DIFFERENTIATED

Face-Differentiated (FD) handaxes have two edges on the same face that are worked in a similar way, and differently to the edges on the opposite face. Face-Differentiated handaxes are characterised by either edges A+B or C+D having a similar number of removals. An example is presented in Figure 6.4:

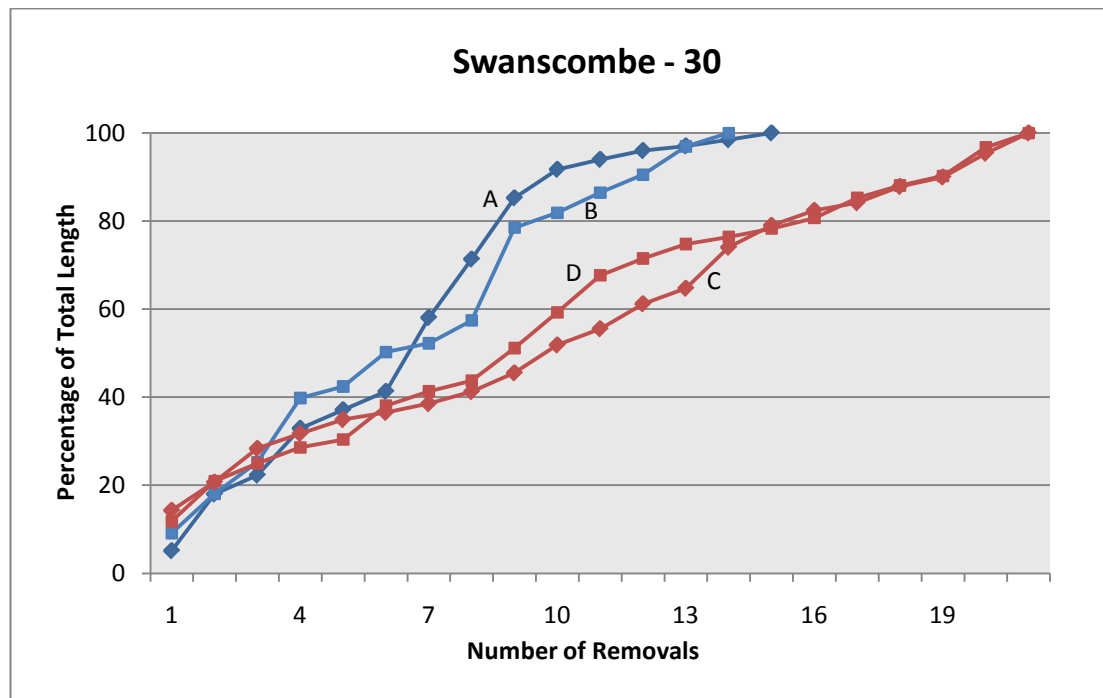


Figure 6. 4: An example of a Face-Differentiated handaxe - 30 (Swanscombe).

In the Figure 6.4, Edges C and D have a total of 21 removals each and exhibit a similar curve on the graph, indicating they were manufactured in a similar fashion. The majority of points on the curves are close together indicating that the removals are consistently small. In contrast, Edges A and B have fewer removals, and some spacings are large and irregular, indicating a lack of standardisation. Figure 6.5 is a diagrammatic representation of the expected pattern for a FD handaxe (with the similar edges marked in the same colour):

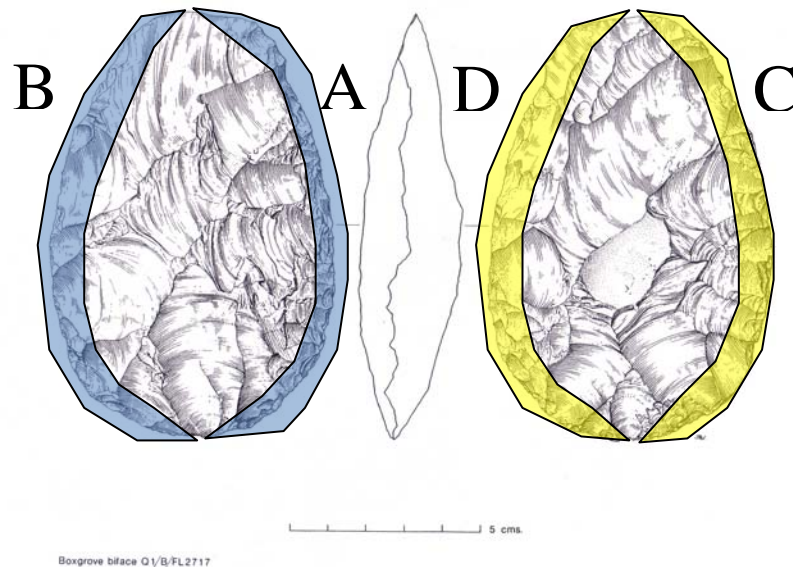


Figure 6. 5: Face-Differentiated handaxe

DUAL-EDGED

There are two possible combinations to this category, both of which are defined on the basis of two edges that are worked preferentially compared to the others. Dual Edge (DE) handaxes do not have similar edges on the same face. The two options are as follows:

1. Dual-Edged - Opposed Edge (DE-OE)

Opposed edge handaxes have two similarly worked edges on opposite faces and opposite sides from each other. The possible combinations for this pattern are edges

A+C and B+D, which is a combination of the right or left edges on both faces. An example is presented in Figure 6.6:

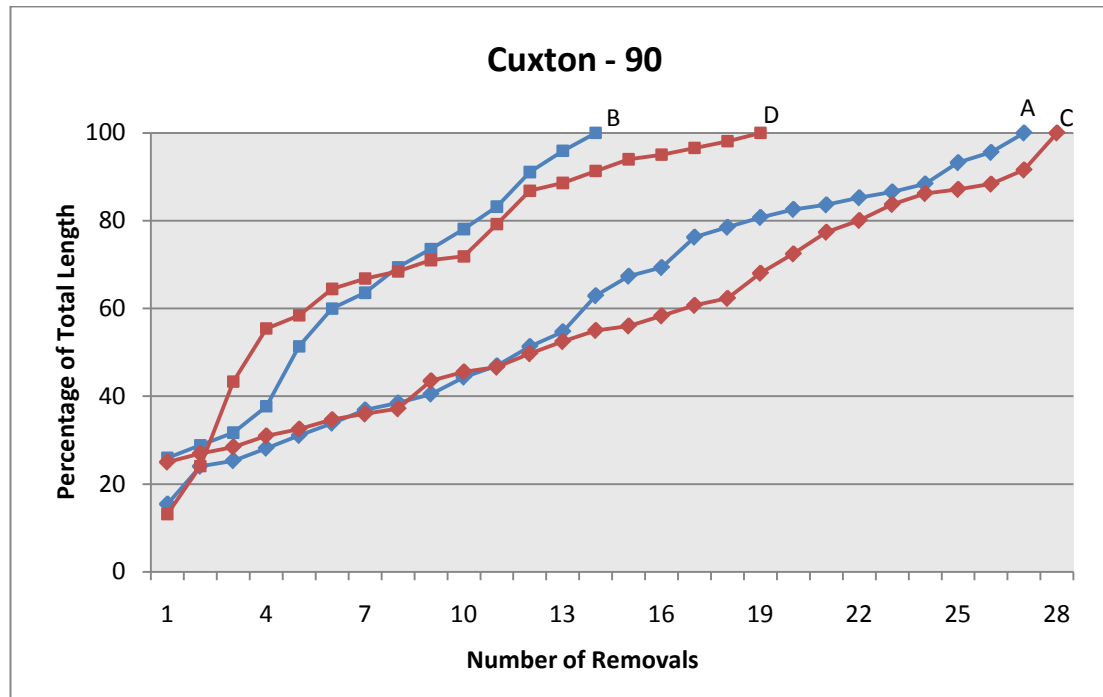


Figure 6. 6: An example of an opposed-edge handaxe - 90 (Cuxton).

In Figure 6.6, Edges A and C have approximately 27 removals each and most points on the curves are close together indicating that the removals are consistently small. In contrast, Edges B and D have fewer removals, and some of the spacings are large and irregular indicating a lack of standardisation. Figure 6.7 is a diagrammatic representation of the expected pattern for an opposed edge handaxe:

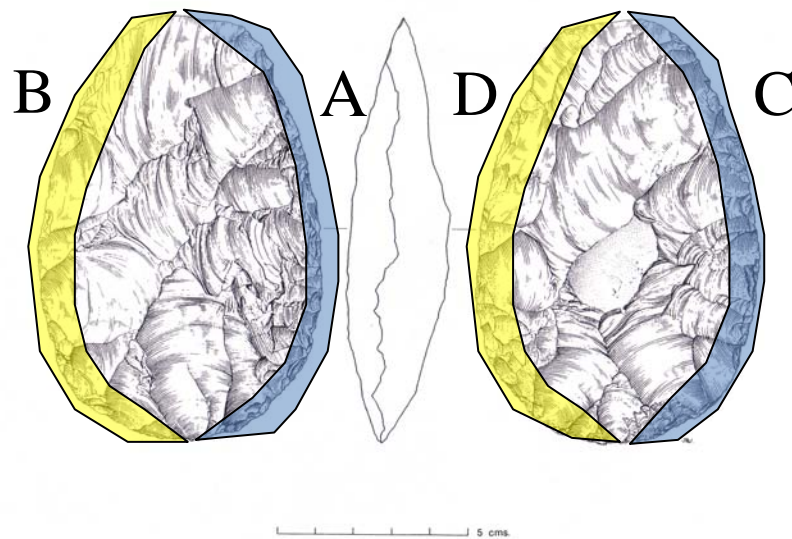


Figure 6. 7: Opposed-edge handaxe.

2. Dual –Edged - Same Edge (DE-SE)

Same edge handaxes have two edges that are similarly worked on opposite faces and the same side (left or right) as each other. The possible combinations for this pattern are Edges A+D and B+C, which are a combination of one right and one left edge on each face. An example is presented in Figure 6.8:

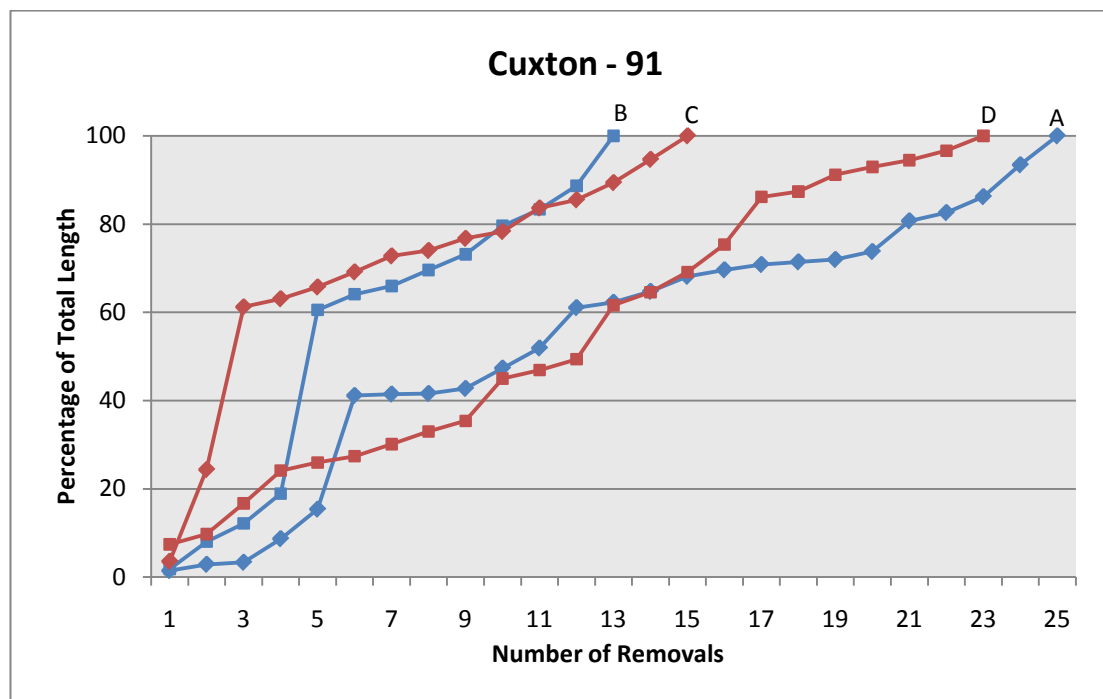


Figure 6. 8: An example of an opposed-edge handaxe - 91 (Cuxton).

In Figure 6.8, Edges A and D have approximately 23 removals each and most points on the curves are closer together than those from Edges B and C. The major difference in the edges for this particular handaxe are that Edges B and C have substantially less working on the butt, with 60% of the total length being made up of 4 or less removals each Edge. Figure 6.9 is a diagrammatic representation of the expected pattern for a same edge handaxe:

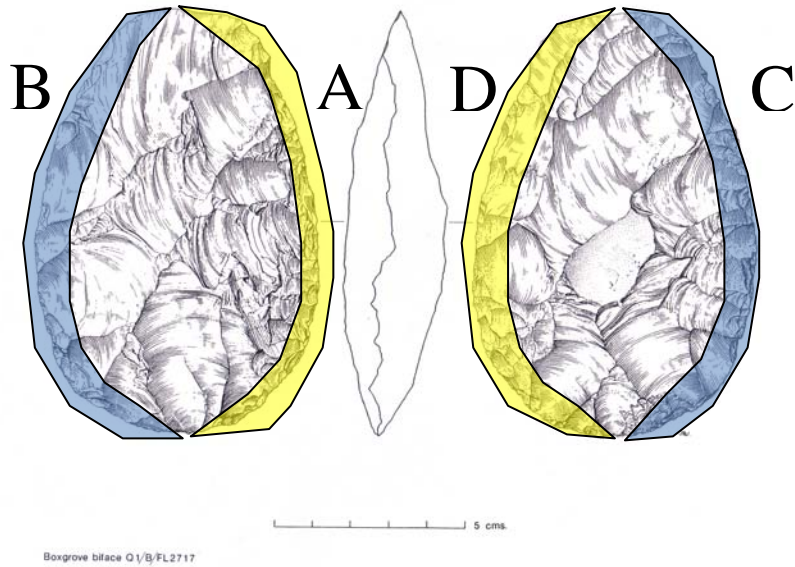


Figure 6.9: Example of a same edge handaxe

SINGLE EDGE

Single edge (SE) handaxes have one edge that is worked in a different fashion to the rest. This can be either Positive (one edge is more worked than the other three) or Negative (one edge is worked less than the other three). An example of each is presented in Figure 6.10 and Figure 6.11:

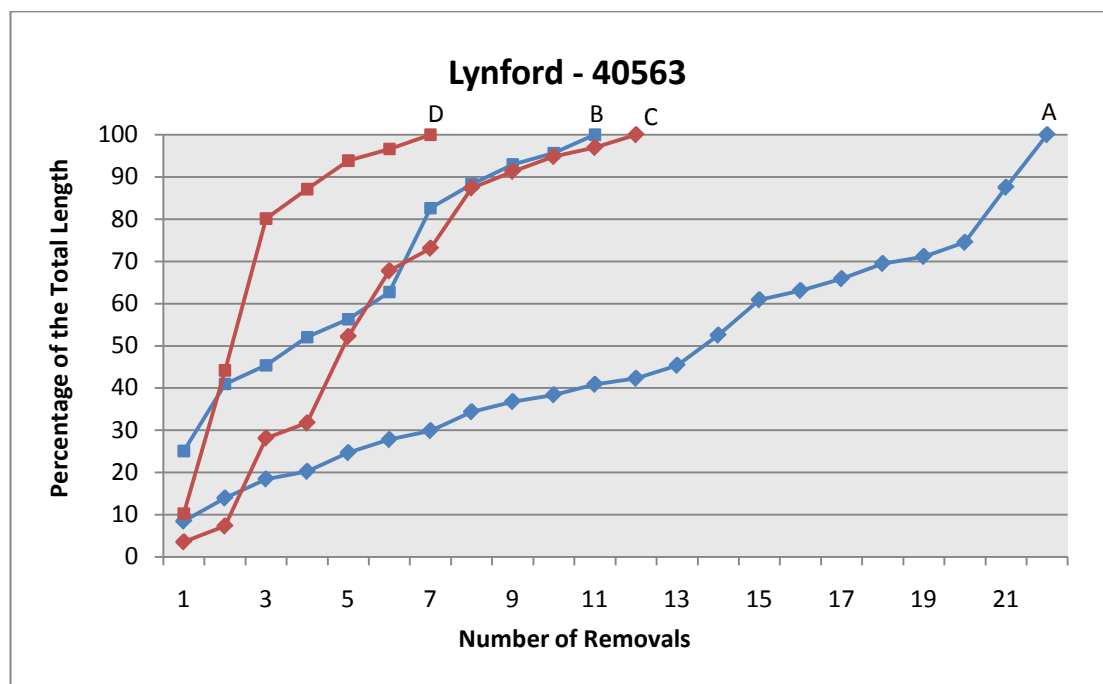


Figure 6.10: An example of a single edge (positive) handaxe – 40563 (Lynford).

In Figure 6.10, Edge D has 22 removals and most points on the curve are closer together than those from Edges A, B and C. The maximum number of removals from any of the other three faces is 12.

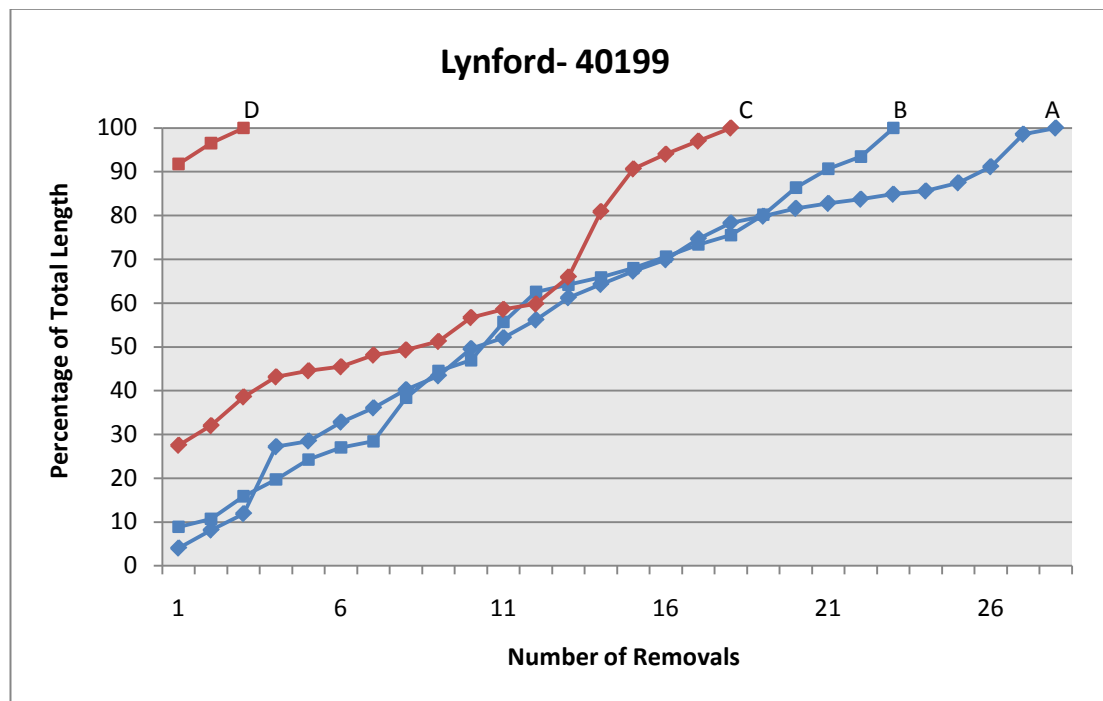


Figure 6. 11: An example of a single edge (negative) handaxe - 40199 (Lynford).

In the Figure 6.11, Edge D has only 3 removals, in contrast to the other three edges which have between 17 and 28. In this case, the points are closely spaced, but on some examples, the spacings will be very wide. A diagrammatic representation of the expected pattern for a single edge handaxe could have either A, B, C or D highlighted.

UNDIFFERENTIATED

Undifferentiated (UD) handaxes have no edges that are worked in a different fashion to the rest. An example of this is presented In Figure 6.12:

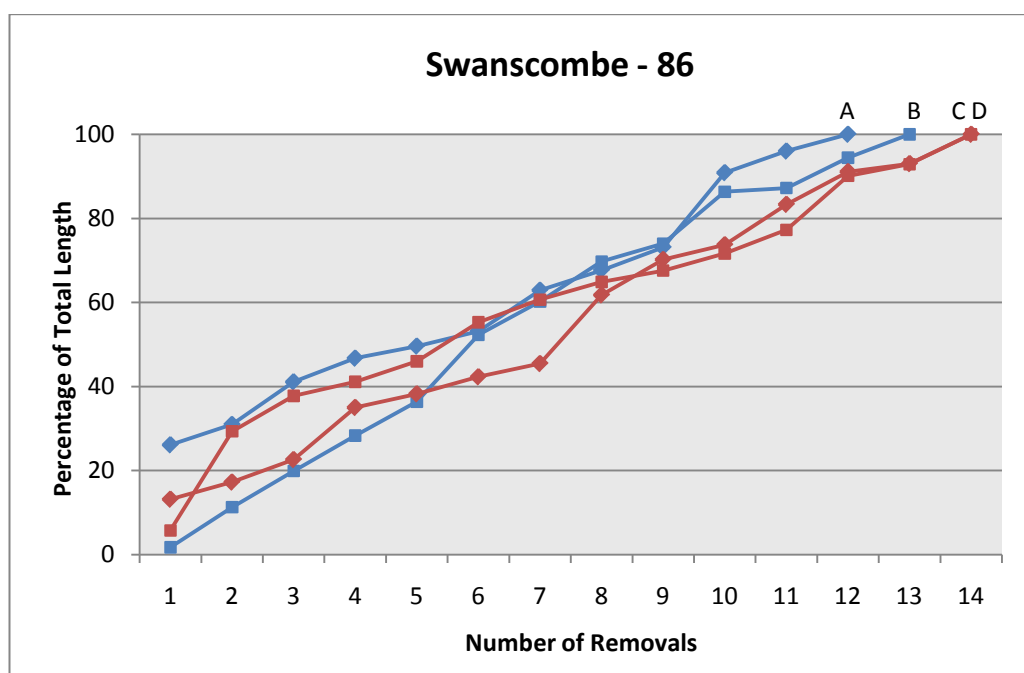


Figure 6. 12: An example of an Undifferentiated handaxe - 86 (Swanscombe).

In Figure 6.12, all edges have between 11 and 13 removals. This is by no means indicative of a lack of patterning as it is just as valid to produce a handaxe with all four edges worked in a similar fashion, and may even indicate a higher level of planning and control.

RANDOM

Theoretically, a handaxe should exhibit a random pattern where no edges are sufficiently similar or different to warrant categorisation. This can be viewed as the Null statement for the study, as if there is no patterning in an assemblage, all handaxes will be of the Random type and therefore will not indicate any signs of deliberate patterning in manufacture. This would be represented as in Figure 6.13:

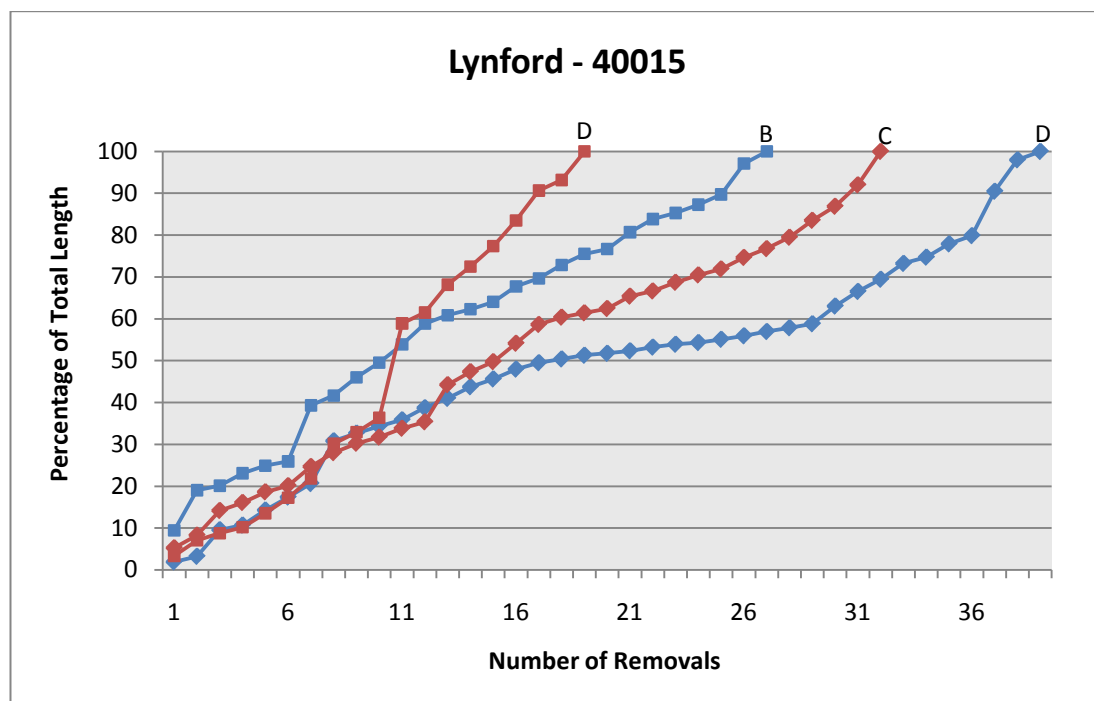


Figure 6. 13: An example of a Random handaxe - 40015 (Lynford).

6.4

INITIAL FINDINGS

A pilot study was initiated to assess the viability of the methodology first concentrating on Lynford and Boxgrove, then widened to a group of seven British and French sites (La Micoque, Le Moustier, Elvedon/Hitchin, Cuxton, Swanscombe, Lynford and Boxgrove) with both Mousterian and Acheulean handaxes. Although the outcome of the pilot was encouraging, some minor adjustments and one substantial refinement were made at this stage as a result of testing the methodology.

The use of graphs as above to make a determination was deemed to be too subjective and rendered the assignment of categories impossible when dealing with a complicated scenario. I therefore devised a replacement method that involves using the figures themselves and computing the differences between the possible combinations. This was calculated as follows:

- The total number of removals for each edge is recorded;

A	B	C	D	Total
18	16	52	44	130

- Each possible combination of edge pattern is calculated by adding the total number of removals on each edge together;

Face	A+B	C+D
Differentiated	34	96

Opposed Edges	A+C	B+D
	70	60

Same Edge	A+D	B+C
	62	68

- This is then adjusted to an average number of removals, for the purposes of comparison, by dividing each total in half;

Face	A+B	Ave	C+D	Ave
Differentiated	34	17	96	48

Opposed Edges	A+C	Ave	B+D	Ave
	70	35	60	30

Same Edge	A+D	Ave	B+C	Ave
	62	31	68	34

- For each combination, the difference between the average number of removals is calculated;

Face	A+B	Ave	C+D	Ave	Diff
Differentiated	34	17	96	48	31

Opposed Edges	A+C	Ave	B+D	Ave	Diff
	70	35	60	30	5

Same Edge	A+D	Ave	B+C	Ave	Diff
	62	31	68	34	3

- The difference for each combination is turned into a percentage by dividing it by the total number of removals for the whole handaxe, and multiplying by 100. This is to illustrate what the percentage difference in average removals is between each face/edge combination relative to the total number of removals. From this, all the percentages can be compared;

A	B	C	D	Total
18	16	52	44	130

Face Diff	A+B	Ave	C+D	Ave	Diff
	34	17	96	48	31
Opp Edge	A+C	Ave	B+D	Ave	Diff
	70	35	60	30	5
Same Edge	A+D	Ave	B+C	Ave	Diff
	62	31	68	34	3

% DIFFERENCE				
Face Diff	Opp Edge	Same Edge	Single Edge	Un-diff
24%	4%	2%		

This handaxe is Face Differentiated as the percentage difference far outstrips the others.

- Where the percentages are too numerically similar, a handaxe is deemed to be Undifferentiated or Random. The distinction between these is decided by whether the four edges have a similar number of removals (Undifferentiated) or completely different numbers of removals (Random);
- The exception is those handaxes which have one edge substantially more or less worked than another which are classified as Single Edge (positive or negative).

An imaginary set of handaxes which represent each of these options is presented below:

a) Face-Differentiated

A	B	C	D	A+B	Ave	C+D	Ave	Diff
18	16	52	44	34	17	96	48	31
Total				A+C	Ave	B+D	Ave	Diff
130				70	35	60	30	5
				A+D	Ave	B+C	Ave	Diff
				62	31	68	34	3

FD	DE-OE	DE-SE	SE	UD
24	4	2		

b) Dual Edge - Opposed Edge

A	B	C	D	A+B	Ave	C+D	Ave	Diff
44	16	52	18	60	30	70	35	5
Total				A+C	Ave	B+D	Ave	Diff
130				96	48	34	17	31
				A+D	Ave	B+C	Ave	Diff
				62	31	68	34	3

FD	DE-OE	DE-SE	SE	UD
4	24	2		

c) Dual Edge – Same Edge

A	B	C	D	A+B	Ave	C+D	Ave	Diff
52	16	18	44	68	34	62	31	3
				A+C	Ave	B+D	Ave	Diff
				70	35	60	30	5
				A+D	Ave	B+C	Ave	Diff
				96	48	34	17	31
Total								
130								

FD	DE-OE	DE - SE	SE	UD
4	2	24		

d) Single Edge

A	B	C	D	A+B	Ave	C+D	Ave	Diff
12	16	50	14	28	14	64	32	18
				A+C	Ave	B+D	Ave	Diff
				62	31	30	15	16
				A+D	Ave	B+C	Ave	Diff
				26	13	66	33	20
Total								
92								

FD	DE-OE	DE - SE	SE	UD
14	12	16	✓	

C is identified as Single Edge (positive).

e) Undifferentiated

A	B	C	D	A+B	Ave	C+D	Ave	Diff
12	14	13	15	26	13	28	14	1
				A+C	Ave	B+D	Ave	Diff
				25	12.5	27	13.5	1
				A+D	Ave	B+C	Ave	Diff
				27	13.5	27	13.5	0
Total								
54								

FD	DE-OE	DE - SE	SE	UD
1	1	0		✓

All edges are similarly worked so this is Undifferentiated.

f) Random

A	B	C	D	A+B	Ave	C+D	Ave	Diff
20	13	9	16	33	16.5	25	12.5	4
				A+C	Ave	B+D	Ave	Diff
				29	14.5	29	14.5	4
				A+D	Ave	B+C	Ave	Diff
				36	18	22	11	7
Total								
58								

FD	DE-OE	DE - SE	SE	UD
3	3	5		

RANDOM

There is still an element of subjectivity inherent within the method as the researcher must decide whether a difference is numerically significant enough to assign to a particular category. Yet, from working with handaxe assemblages for the pilot study, rarely do ambiguous patterns occur, and even then the Random category provides a null value.

From these patterns a hypothesis can be suggested: If the majority of handaxes in an assemblage exhibit non-random patterning, the evidence for resharpening is strong. This is countered by the null hypothesis that if the majority of handaxes in an assemblage exhibit a random-edged pattern then the evidence for resharpening is

weak. This assumes that resharpening and the associated edge patterning imply a degree of control over the way the handaxe is knapped and that the patterning evidenced is deliberately created. Random patterning therefore implies a lack of control and can reflect ad-hoc rapid manufacture. The patterning can be compared with the average number of removals per handaxe, relative to length, to examine whether the intensity of resharpening is quantifiable.

6.5

INITIAL RESULTS

The Edge-Patterning methodology is designed to highlight one aspect of handaxe variability, that which reflects the available choices of the knapper when creating a handaxe, such as raw material type and size, roughing out and shaping trajectories and the imposition of form and function. The categories that have been defined are designed to document variability within and between assemblages based on the differing percentages of each type of pattern that are represented. Beyond this, it should be possible to interpret these categories on the basis of hominin behaviour by relating the different types of handaxe to the context within which they were created.

Through the collection of data for this study, a further pattern was identified to supplement those outlined above. Contained within the scope of the Single Edge category, there were 43 handaxes which showed a pattern where one edge was preferentially worked and another was underworked, in effect combining the negative and positive aspects of the Single Edge category. This can occur on any combination of edges, although in half of the cases the pattern was displayed on both sides of the same edge. To document this, I created the SE-NP category (NP = Negative/Positive). The graph displayed below is a good example of an SE-NP

handaxe, with edges A and D exhibiting a high/low number of removals, comprising the right hand edge, with B and C exhibiting a similar number of removals to each other and falling in the middle of the range.

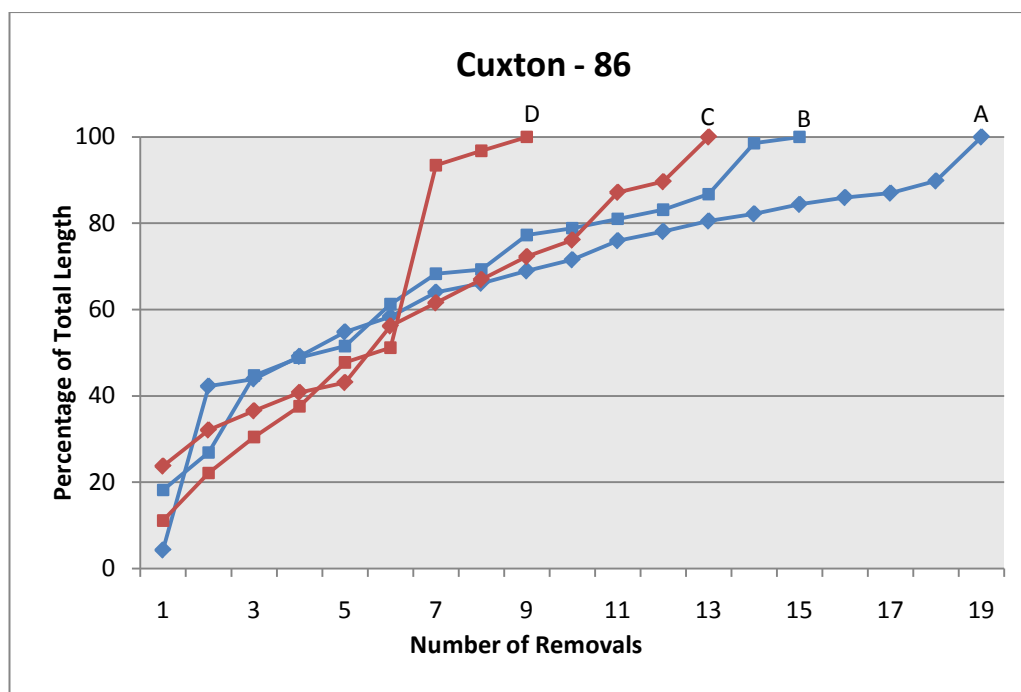


Figure 6. 14: Graphical representation of the edges of handaxe 86 (Cuxton).

Using the methods and categories outlined above, the attributes of 348 handaxes, were recorded giving a total of 1308 different edges. The results are displayed below (percentages were omitted for small assemblages):

Site	Total		Face Diff	Dual Edge	Single Edge	Un-Diff	Random	Average Removals per Handaxe	Average Removals / Handaxe Length
Berinsfield	23	n %	6 26	2 8	4 17	8 35	3 13	52	0.42
Boxgrove	30	n %	1 3	13 53	6 20	6 20	4 13	83	0.65
Broom	15	n %	2 13	5 33	3 20	4 27	1 7	44	0.34
Caddington	19	n %	4 21	6 33	4 21	3 16	2 11	26	0.49
Coygan	3	n	1		2			43	0.45
Cuxton	30	n %	3 10	11 37	10 33	4 13	2 7	55	0.45
Great Pan Farm	67	n %	10 15	16 24	20 30	9 13	12 18	45	0.54
Hitchin	18	n %	7 39	1 6	5 28	4 22	1 6	52	0.43

Site	Total		Face Diff	Dual Edge	Single Edge	Un-Diff	Random	Average Removals per Handaxe	Average Removals / Handaxe Length
Lynford	35	n %	9 26	10 29	11 31	2 6	3 9	121	1.21
Pontnewydd	26	n %	3 12	8 33	4 15	7 27	4 15	29	0.30
Red Barns	5	n	2	1	2			41	0.46
Stanton Harcourt	28	n %	3 11	8 29	7 25	5 18	5 18	39	0.33
Swanscombe	15	n %	2 13	3 20	2 13	6 40	2 13	49	0.44
Wolvercote	34	n %	7 21	11 33	8 24	4 12	4 12	65	0.56
Total Handaxes	348	n %	60 17	95 28	88 25	62 18	43 12		

Table 6. 2: Figures for the Edge Patterning exercise.

From the table above, it can be seen that 88% of handaxes exhibited a non-random patterning, supporting the hypothesis that evidence for resharpening is strong in all the assemblages in the study. No assemblage had random handaxes totalling greater than 18% of the total. Of the 88% of patterned handaxes, the two most represented categories are the Dual and Single Edge categories and the Undifferentiated and Face-Differentiated categories are also well represented, meaning that overall no one pattern is dominant.

6.6

CONCLUSION

The edge-patterning methodology has explored one method of looking at resharpening in handaxe assemblages. It has provided some insights into the types of resharpening that are taking place within these assemblages and defined some of the possible patterns of edge-resharpening. The following chapter takes these insights and continues the examination of resharpening as a causal factor in handaxe variation, suggesting some of the mechanisms for resharpening and outlining a terminology and model for categorising and interpreting this variation.



CHAPTER SEVEN: RESHARPENING IN CONTEXT

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In the preceding chapters, I have examined the basis for categorising variability in handaxe form (Roe, 1968) and two of the main theories that have attempted to explain this variation (Ashton and McNabb, 1994; White, 1998a; McPherron, 1995). I have suggested that there are problems inherent within Roe's (1968) terminology and with McPherron's (1995) methodology which render them unsuitable frameworks within which to discuss variability. Yet, the results of the McPherron (1995) analysis in Chapter 5 did indicate that resharpening was a causal factor in the creation of handaxe variability although there was little to support the assertion that pointed handaxes were being reduced into ovate handaxes through resharpening. The analysis undertaken in Chapter 6 suggested the possibility of a continuum of resharpening represented within assemblages that was focussed on handaxe edges, echoing the extended chaîne opératoire suggested by Shott (1989; 1996) in his use-life concept. The exact nature of the resharpening trajectories that result in distinctive handaxe forms is not clear, and it is the purpose of this chapter to begin to examine these trajectories.

Chapter 6 recognised the need for the creation of a different methodology to elucidate the perceived variability both within and between handaxe-dominated assemblages. This research indicated that resharpening was indeed influencing handaxe form, albeit in a way not succinctly captured by the edge sharpening methodology. When coupled with the conclusion reached in Chapter 3 that the current scheme of terminology used to categorise handaxe shape is loaded with semantic connotations, the logical next step was to outline a theoretical framework

with new terminology based on a continuum of reduction. With this in mind, Chapter 7 presents a nascent approach to defining the processes, trajectories and end products of resharpening in handaxe assemblages.

The decision to focus on handaxe edges in Chapter 6 was based on the assumption that the edge would be most impacted by the process of resharpening, and therefore that handaxe edges should preserve evidence of differential and compartmentalised reduction. Handaxe edges were chosen as the method for examining variability as a means of creating distinct categories into which tools could be placed, and also to provide the scope for further interpretation. Whilst providing evidence that resharpening was indeed impacting upon handaxe form and giving rise to the notion of continuums of form and resharpening, it did little to elucidate the particular trajectories that this resharpening was taking. The results did point to a particular emphasis on edges or single faces and, with this in mind, the focus of the work turned back to the individual objects, to look for evidence for resharpening trajectories. This research was directed primarily at Boxgrove handaxes as they represented potentially the least limited assemblage in the study, with good raw material quality and availability offering potentially a wide variety of reduction and resharpening trajectories. The following chapter outlines the results of this analysis and then takes the observations from Boxgrove and applies them to other sites in the study group.

7.2

SEARCHING FOR PREFERRED FORM

Throughout the course of this study, it has not been possible to reject the central tenet of the raw material hypothesis (White, 1998a), that raw material quality and form

affects the knapping process. The extent to which this impacts the final form of a handaxe is called into question if resharpening is occurring, as it may not be possible to see the initial intended form of a handaxe if there indeed was one. Boxgrove becomes important to this debate as it affords the opportunity to study handaxes produced with arguably very few limitations on knapping decisions. The abundant good quality raw material located adjacent to the site and the large assemblage size (Roberts and Parfitt, 1999) should by definition allow a detailed examination of White's (1998a) 'preferred form' in order to assess if there are distinctive intended outcomes of the knapping process and to provide a baseline for comparing divergence from this ideal. The following discussion examines whether it is possible to describe an 'ideal' handaxe, by looking at the outcome of knapping strategies in cases of good raw material quality and availability.

In the course of extensive research throughout the past decade, both Ashton (and McNabb, 1994) and White (1995; 1996; 1999; 2002) have attempted to define what qualities are desirable in the 'ideal' handaxe. They summarised their findings (Ashton and White, 2002) by concluding that raw material was still the biggest influence over manufacturing techniques, but that the 'mental construct' used when creating a handaxe consisted of the following four features:

- Bifacial flaking;
- A sharp, durable cutting edge;
- Broad symmetry;
- Good prehensile qualities.

The extent to which the raw material conditioned the knapper, restricted his/her ability to affect these features in the final form of the handaxe. If the raw material was of sufficient size and quality to enable the knapper to successfully produce a

handaxe containing all these features, including the creation of White's (1998a) 'preferred' ovate, what form would this handaxe take? The technological attributes of this handaxe have been considered already, with the preferred ovate handaxe being created as a piece with its centre of gravity in the middle, allowing the complete circumference to be utilised (White, 1998a).

In order to look for preferred form at Boxgrove, it was necessary to return both to the individual handaxes and also the dataset and look at the metrical data in more detail. The following is a summary of the results of this analysis.

7.2.1 RETURNING TO BOXGROVE

When dealing with a site with a ready supply of good raw material, it is necessary to think about which circumstances produce the greatest potential for creating an ideal form. Nodules conditioned by extreme shapes and/or sizes are unlikely to be utilised when there are alternatives (White, 1998a). It is therefore informative to look at the relationship between planform and overall length, where length is a proxy for overall size. To do this, the complete handaxe assemblage at Boxgrove was divided along the lines of length into the longest and the shortest 10%, with the remaining handaxes divided into thirds. These five separate data sub-sets were plotted beside each other on the graph against the figure of planform (L/L1):

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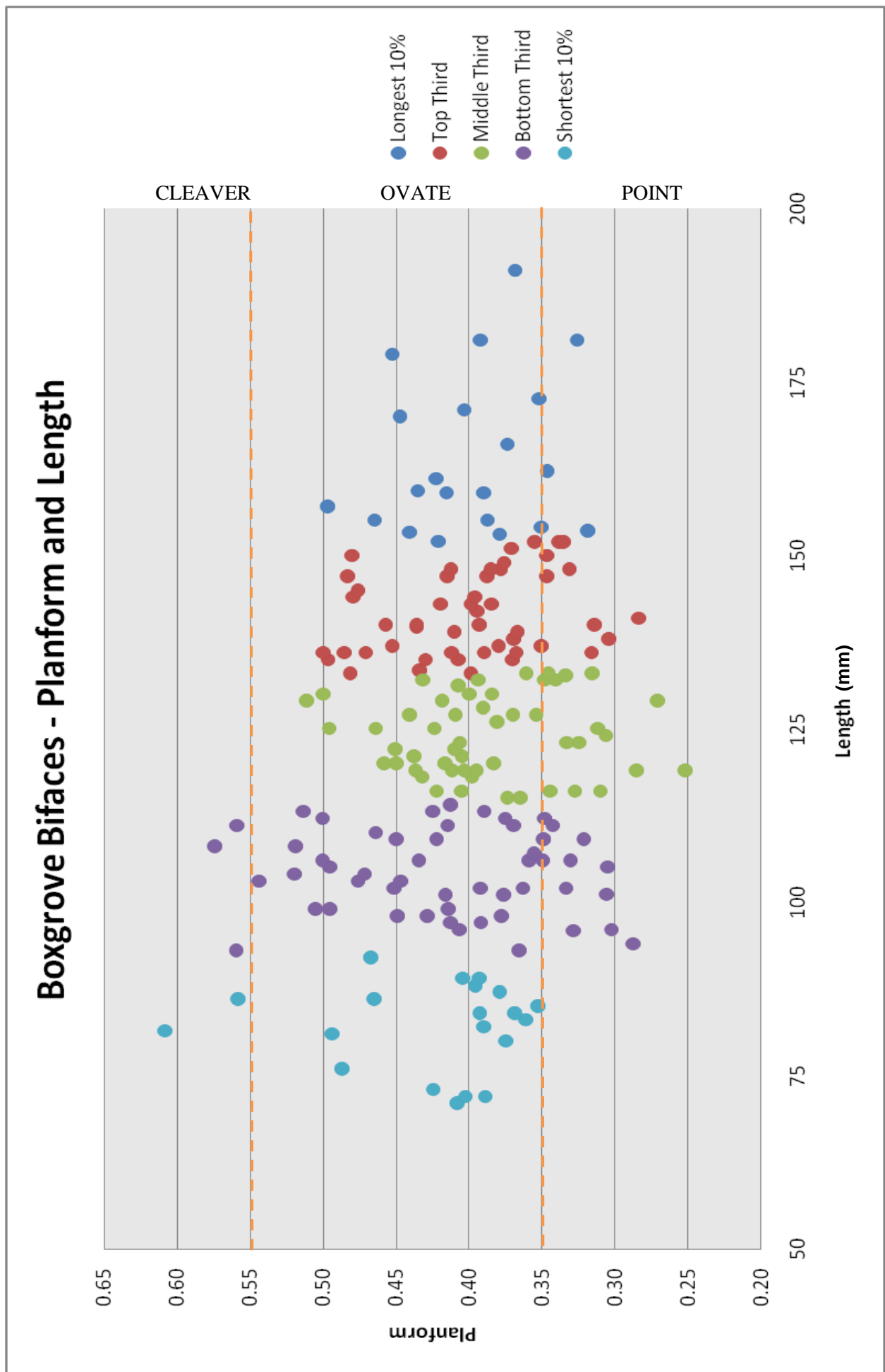


Figure 7. 1: Boxgrove handaxe assemblage with length plotted against planform.

The results were startling. Rather than a random pattern of varying shape and size, the results formed a continuum of variation from the longest to the shortest. Figure 7.1 shows the shortest handaxes to the left hand side of the graph, the longest on the right hand side. What is evident is that the longest handaxes have a very restricted range of variation in planform and that the decrease in size sees an increase in the amount of variation with the exception of the smallest 10% category. The smallest handaxes at Boxgrove may therefore have afforded a more limited range of possibilities for shaping. There is also a drift towards the more extreme ovate/cleaver forms with the cleavers only occurring in the shortest two categories. There are only two clearly pointed forms in the longest 10% group and both of these are close to the point/ovate divide. There are also no pointed handaxes in the shortest 10% sample. It can be extrapolated that smaller pieces of raw material and smaller handaxes are more constrained than larger ones. Therefore the lack of pointed handaxes in the shortest category is contra to the expectations of the raw material hypothesis which predicts pointed handaxes from the most constrained raw material (White, 1998a). It is easier to demonstrate the pattern observable at Boxgrove by comparing it to other sites. If it is the quality and availability of good quality raw material that is important, it would be expected that those sites with similar conditions to Boxgrove would show a similar pattern, whilst those with restrictive, poor quality raw material would show no pattern. For comparison, the charts for Warren Hill and Cuxton are displayed below:

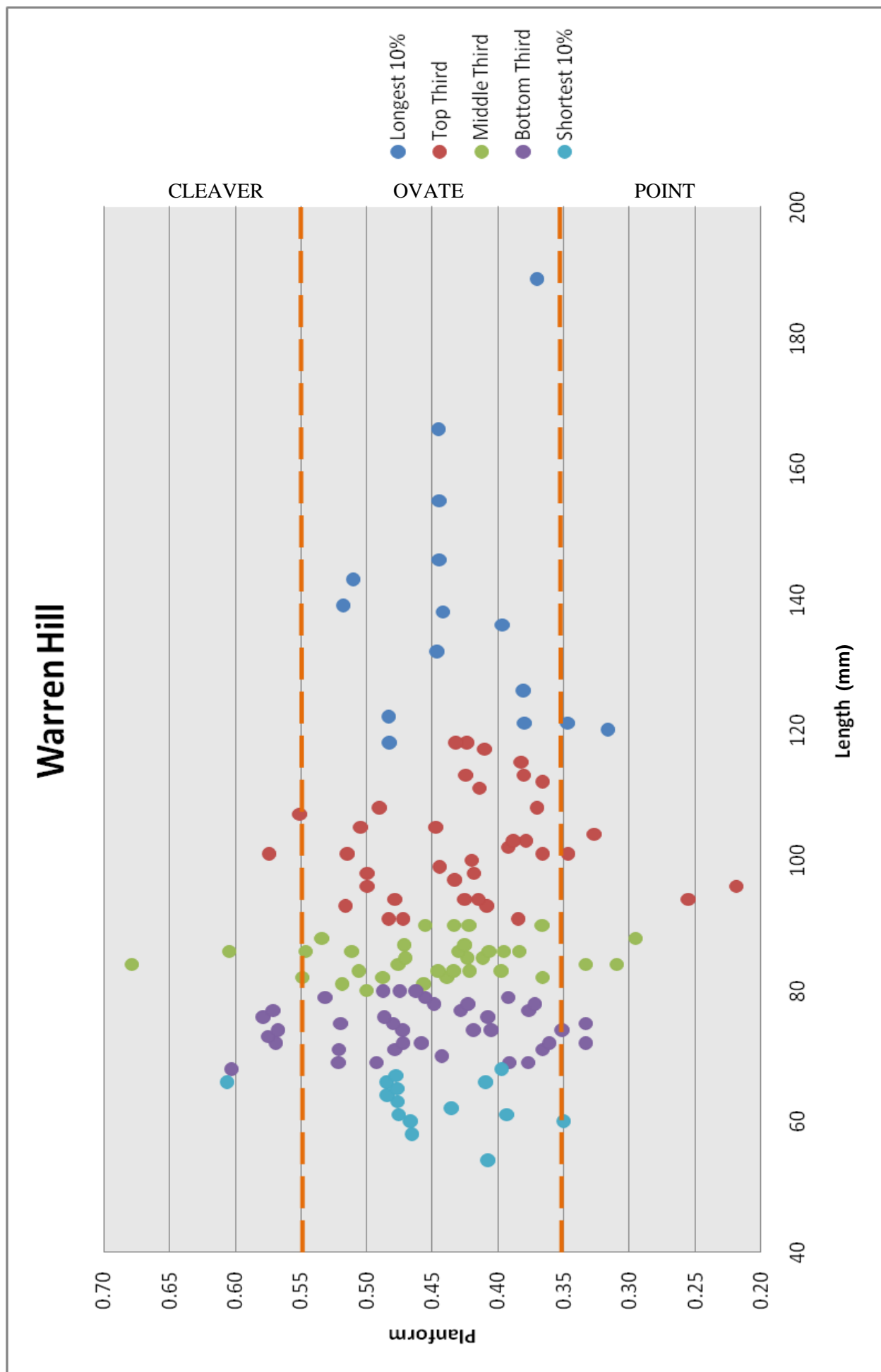


Figure 7. 2: Warren Hill handaxe assemblage with length plotted against planform.

Warren Hill shows a similar pattern but the points are more dispersed. It is noticeable that the longest 10% and 'top third' categories cover a wider distribution of length than the three shorter categories, indicating that there is a greater range of length contained within them. This is due to a greater number of the handaxes being less than 100mm in length, with 75% of Warren Hill handaxes sub-10cm compared to 17% at Boxgrove. Boxgrove has no handaxes under 71mm in the sample whereas at Warren Hill, 14% are between 54mm and 70mm. Interestingly though, this has not changed the overall pattern significantly, although there are fewer non-ovate handaxes overall at Warren Hill. It could be argued that it would be better to compare the variation within set length groupings, such as 100-125mm, 125-150mm but I believe that this method is more effective as it represents the range of material size available at each site. Figure 7.3 (below) shows that the picture at Cuxton could not be more different. Please note the difference in the scale on the Cuxton diagram.

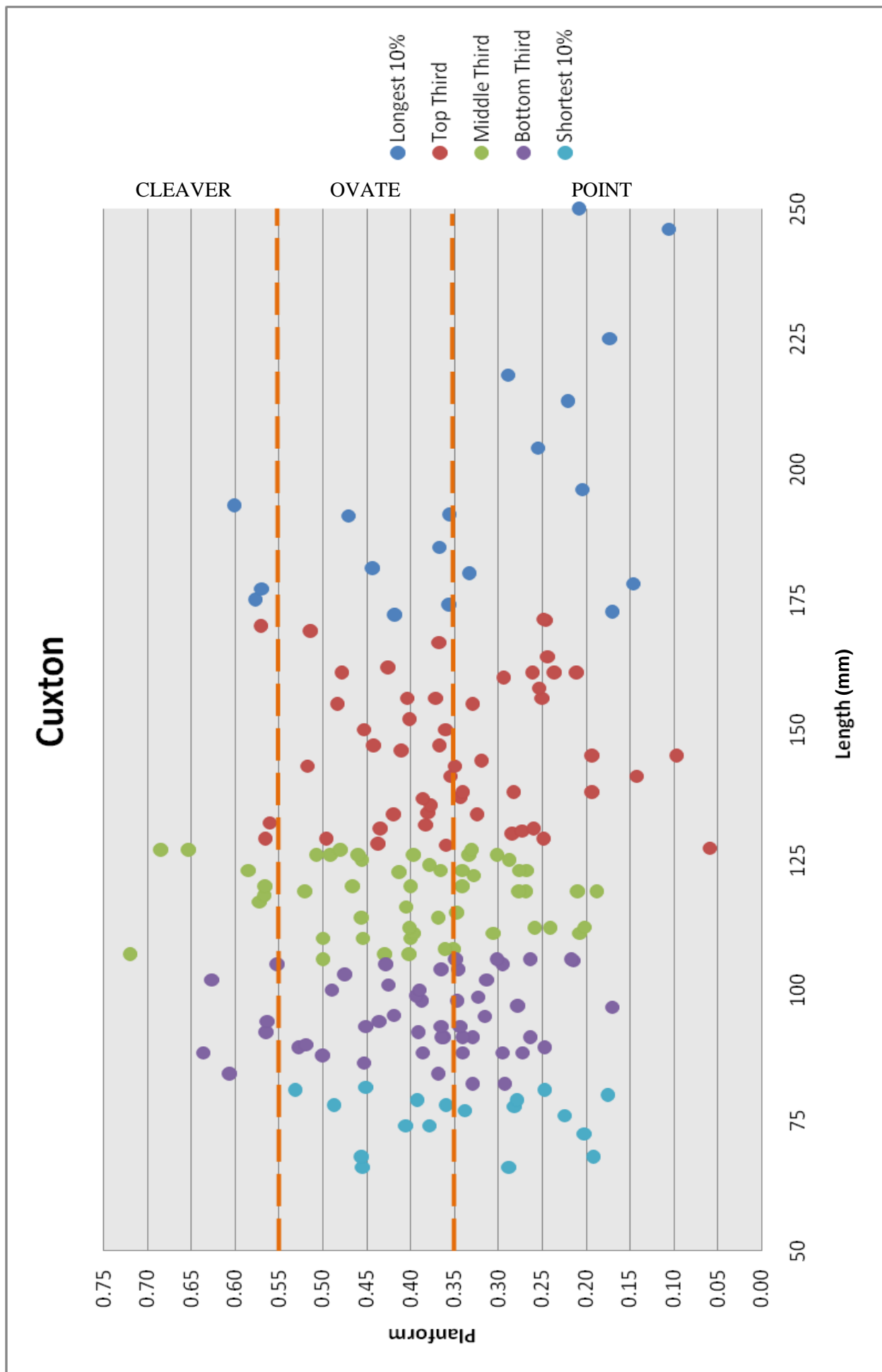


Figure 7. 3: Cuxton handaxe assemblage with length plotted against planform.

Cuxton shows a general lack of patterning, with a large range of variation in each length grouping. All of the largest 5% of handaxes are pointed in the extreme and cleaver types are represented in all size groupings. The longest 10% grouping is widely spread, encompassing handaxes from 170-250mm in length. This suggests that there is little relationship between handaxe length and planform. Of the largest 10%, those over 190mm in length are all pointed, and this indicates that with even the largest pieces of raw material being constricted in shape, it was not possible to create ovate forms of substantial length, and so edge length was maximised by the creation of long, pointed handaxes. These still attempt to conform to the idealised mental construct outlined earlier in this chapter. They are bifacially flaked, and there has been an attempt to create a long, sharp edge – although it may be argued that this edge must have been prone to snapping due to its extended length and narrow breadth (Figure 7.4). There is still an attempt at symmetry but the handaxe cannot be used to cut through rotating the edge (Machin, 2006) and is skewed towards bottom-heavy weighting which means that it does not conform to the preferred form of the ovate.



Figure 7. 4: Example of an elongated Cuxton handaxe. Photo KE.

The above graphs suggest that different factors are contributing to the variation at each site. At Cuxton, the large range of variation is seemingly linked to the raw material and the response of the knapper to the intractable nature of the pipe flint. At Warren Hill, the lack of larger sizes of handaxes seems to have produced a restricted range of variation, with a predominance of ovate forms. When a Boxgrove hominin was faced with a large block of good quality raw material, the range of possibilities were substantial. However, the range of outcomes was not, suggesting that even with seemingly limitless possibilities a fixed route of manufacture was adhered to. This route became more and more difficult the smaller the blank, resulting in a wider range of variation in planform. However, resharpening at Boxgrove did not result in a continuum of variation from point to ovate. The overriding conclusion is that the 'unconstrained' hominin had a very specific view of what he/she wanted to create. With few exceptions, the larger blanks of raw material have been fashioned into ovates and points approaching the point/ovate divide which is seemingly a ringing endorsement for the 'preferred form' theory (Ashton and White, 2003). However, a correlation between size and shape is not supported when the length of the handaxes reaches the smaller end of the spectrum.

Gowlett (2005) looked at the nature of extreme handaxes and their relationship to an assemblage as a whole. For Gowlett (2005) extreme handaxes were those which diverged from the mean by 1 standard deviation or more in any measure. His paper asserted two key points: that handaxes which were extreme in one measure, rarely were extreme across the spectrum; and that shorter handaxes varied more from the mean than longer handaxes, suggesting that there is less choice for a knapper creating a long handaxe. These assertions were based on data from East African Acheulean assemblages. For comparison he used the smaller assemblage from

Beeches Pit (Suffolk) to show the range of individual idiosyncratic styles and forms which seemed to render an assemblage wide comparison pointless. To examine the nature of the extreme handaxes at Boxgrove, I decided to test these two hypotheses. The results were as follows:

Measurement		Mean	StDev
Length	Longest (n=35)	158.19	11.39
	All (n=201)	123.25	24.27
	Shortest (n=33)	86.51	8.82
Tip Length	Longest	96.55	9.81
	All	73.75	17.17
	Shortest	50.83	8.69
Breadth	Longest	98.35	8.17
	All	80.93	13.70
	Shortest	60.70	6.13
Thickness	Longest	35.70	5.01
	All	30.19	5.72
	Shortest	24.48	4.85

Table 7. 1: Average and standard deviation measurements for the longest, shortest and all handaxes from Boxgrove.

The data from Table 7.1 is translated into Figure 7.5 below which shows the standard measures of Length, Tip Length, Breadth and Thickness displayed as a mean (coloured circle) with one standard deviation above and below (black line). The East African assemblages in Gowlett's (2005) study showed that the majority of handaxes from these sites were generally extreme in only one or two measurements out of nine total measurements taken. The percentage of extreme handaxes matches well with the percentage from Kilombe EH at 32% for both Boxgrove and Kilombe EH.

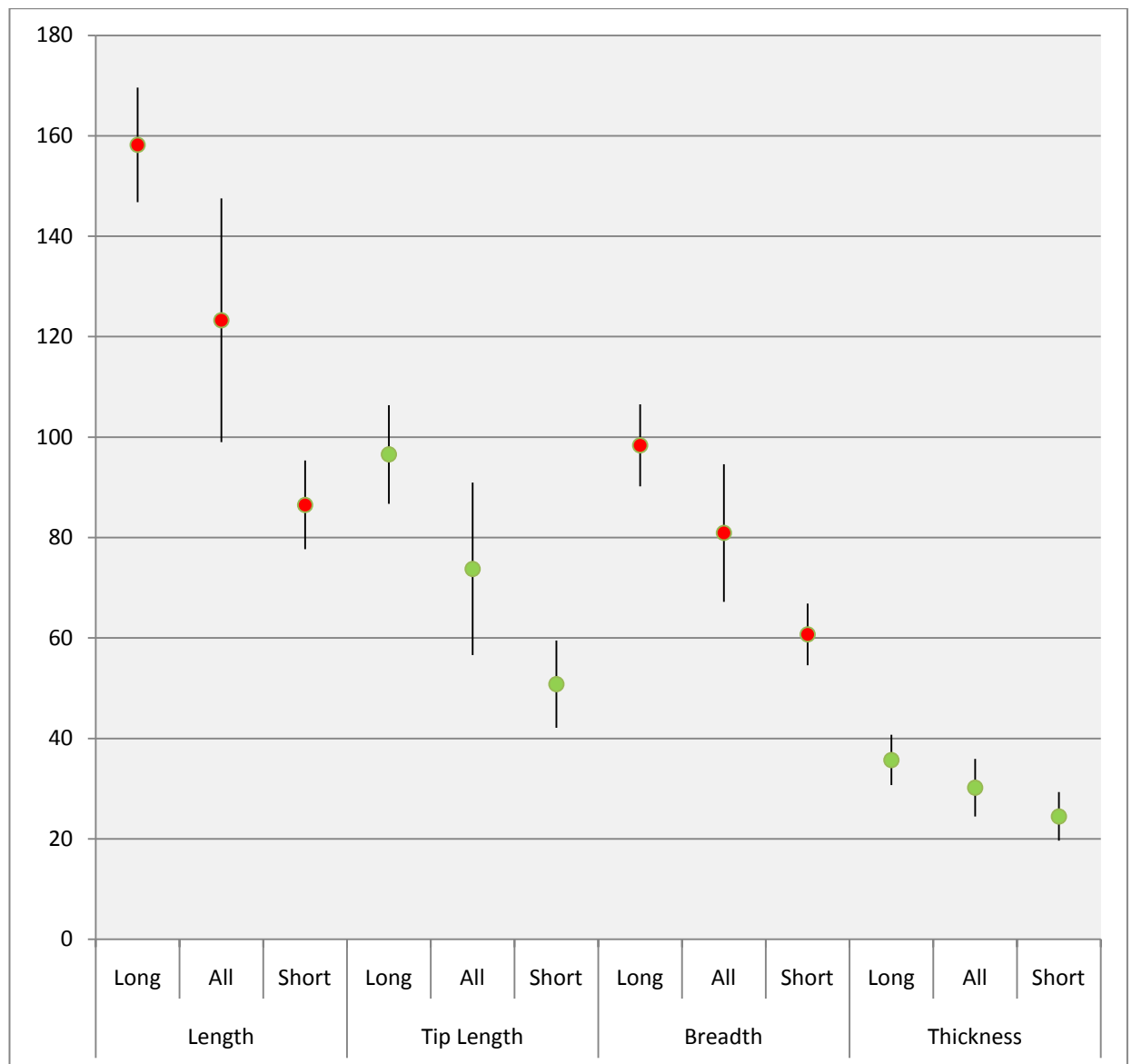


Figure 7. 5: Graphical representation of means and standard deviation of handaxes from Boxgrove.

From Figure 7.5 it can be seen that Boxgrove handaxes maintain their ‘extreme’ proportions well across the four measures. Although each successive measure involves a degree more of overlap, there is a general pattern that shows that long handaxes have the longer tips, are consistently wider and thicker than their shorter counterparts. Longer handaxes were also more likely to maintain their extremes than smaller handaxes, across a series of measures – 78% had measurements higher than the standard deviation from the mean in length, breadth and thickness. To investigate

this further, the same logic was applied to the measures of planform, elongation and refinement:

Ratio		Mean	StDev
Elongation	Longest	0.62	0.05
	All	0.66	0.05
	Shortest	0.70	0.06
Refinement	Longest	0.36	0.05
	All	0.37	0.05
	Shortest	0.40	0.07
Planform	Longest	0.39	0.04
	All	0.40	0.06
	Shortest	0.41	0.07

Table 7. 2: Average and standard deviation ratios for the longest, shortest and all handaxes from Boxgrove.

The first point to note with Table 7.2 is that the standard deviations are similar for both the elongation and refinement measures, indicating that shorter handaxes do not vary significantly more than longer handaxes. The longer Kilombe EH handaxes (Gowlett, 2005) showed, on average, double the amount of variation for elongation and refinement when compared to the shorter handaxes. This does not appear to be replicated at Boxgrove, with the exception of the planform measure where longer handaxes are more restricted than the shorter handaxes (as demonstrated earlier). The figures from Table 7.2 are graphically represented in Figure 7.6 below:

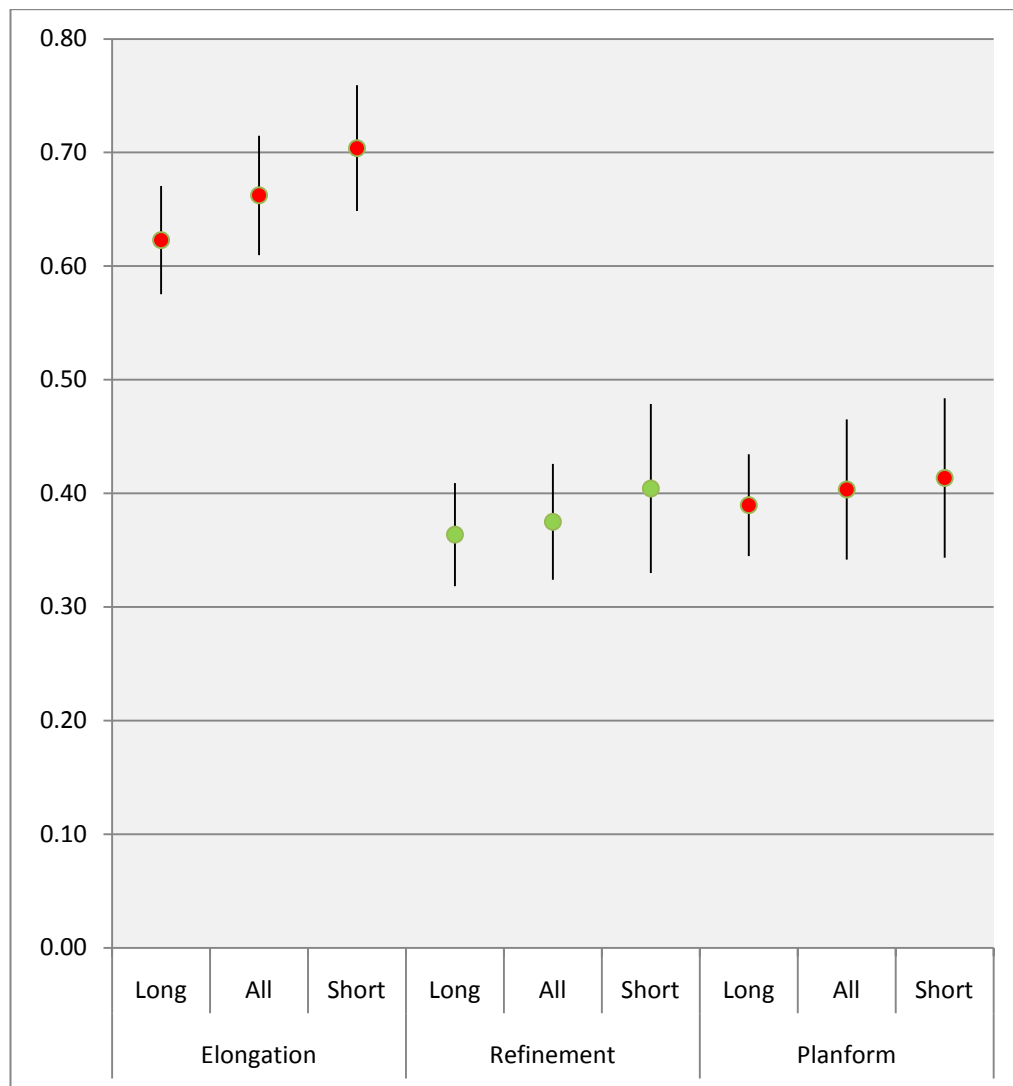


Figure 7. 6: Graphical representation of means and standard deviation of handaxes from Boxgrove.

Figure 7.6 shows that the refinement and planform of handaxes at Boxgrove remains fairly consistent when the longest and shortest are compared to the mean of the whole assemblage. This consistency would suggest that the relationship between thickness and breadth and tip to butt is maintained across the size range. Elongation bears more resemblance to the previous graph, with longer handaxes more elongated than shorter ones, albeit with considerable overlap. When combined with the similarity of the relationship between length and tip length in Figure 7.5, it appears that the primary variation between the extremes in the length of the tip and, by association, the relative elongation of the handaxes, as the breadth/width relationship

remains constant. The fact that the reduction of the tip is not having a concomitant effect on planform suggests that the point of maximum width is being manipulated.

The influence of raw material length on planform at Boxgrove appears that longer pieces of raw material are crafted into a fairly specific form. It became obvious that it would be necessary to examine the longest 10% of the Boxgrove handaxe sample in order to visually assess any similarities between them in form and manufacture. Two of these handaxes are pictured below:



Figure 7. 7: Two Boxgrove handaxes – representing part of the top 10% longest handaxe group (Photos: KE).

Visually, handaxe a) is not what would typically be classified under Wymer (1964) as an ovate, with fairly straight convergent edges on the tip portion of the handaxe. Handaxe b) seems more ‘ovate’ in shape but it far from symmetrical and appears affected by the remnant cortex on the convex face. The presence of remnant cortex

on the handaxes may also indicate that they are still in the initial stages of manufacture and have been discarded when there was still a large amount of potential utility left in their use-life (Shott, 1989). The most striking thing about both handaxes in Figure 7.7 is the presence of transverse tranchet removals on the tip of both handaxes, indicative of resharpening. Clearly both handaxes have already been reduced down from their original form, affecting both the length and the form of the handaxes. Tranchet resharpening was common on the majority of the longest 10% handaxes group and is found throughout the Boxgrove handaxe assemblage. The following section considers the impact that tranchet sharpening has on the form of handaxes from Boxgrove.

7.2.2 TRANCHET REMOVALS ON BOXGROVE HANDAXES AND CLEAVERS IN THE BRITISH PALAEOLITHIC

Tranchet sharpening is evidenced to differing degrees on handaxes throughout the Lower and Middle Palaeolithic. A tranchet flake can be removed at a transverse or oblique angle from the tip of a handaxe often resulting in varied tip morphologies (see Figure 7.8, below). Handaxes can be sharpened by one blow or several, sometime to both sides of the tip. Tranchet removals from the tip of a handaxe are common on both *bout coupé* and Acheulean handaxes. They are believed to be a form of sharpening that renders a sharp, thin edge to the top of a handaxe, although it is possible that it is the flake that is sought after (Wymer, 1999). The lack of use wear on the tranchet flakes at Boxgrove renders the utility option somewhat unlikely however (Pope, *pers. comm.*). To some researchers the tranchet flake represents something of a terminal point to further resharpening but Austin (1993) sees it as simply a method of thinning a handaxe.

Tranchet sharpening is especially prevalent at Boxgrove (Field, 2005) and the effects of such processes were discussed briefly above. Field (2005) discusses tranchet sharpening at Boxgrove and La Cotte de St Brelade and outlines three possible explanations for tranchet removals: the creation of a sharp edge for butchery (functional); raw material conservation or a cultural manufacturing process. Field prefers the latter explanation, whilst Pope and Roberts (2005) see tranchet sharpening as a response to increased mobility within a landscape, in which handaxes are transported away from good raw material sources and resharpened to prolong their use-life.



Figure 7. 8: Tranchet sharpened handaxe from Boxgrove (left) and an example of an oblique (top) and transverse (bottom) tranchet removal (Photos: KE).

The above observations about the presence of tranchet removals on the large Boxgrove handaxes were made after the instigation and completion of the Raw Materials and Resharpener analysis in the preceding chapter. What did not figure into either the White (1995) or McPherron (1994) analyses was the impact that tranchet resharpener could have on the form of the handaxe, and how this would relate to Roe's (1968) metrical scheme. As mentioned in Chapter 3, White (2006) has more recently talked about cleavers as a type in the British Palaeolithic. The category of metrical cleaver (Roe, 1968) may subsume types which would not be visually categorised as a cleaver (Tixier, 1957) due to the absence of a '*broad, fairly straight and low-angled cutting edge at the tip*' (White, 2006, 367). White sees the application of tranchet resharpener as unique to round-edged implements although this is disputed by the recently excavated ficron at Cuxton (Wenban-Smith, 2004, see below) which was found alongside a large cleaver, also tranchet sharpened.

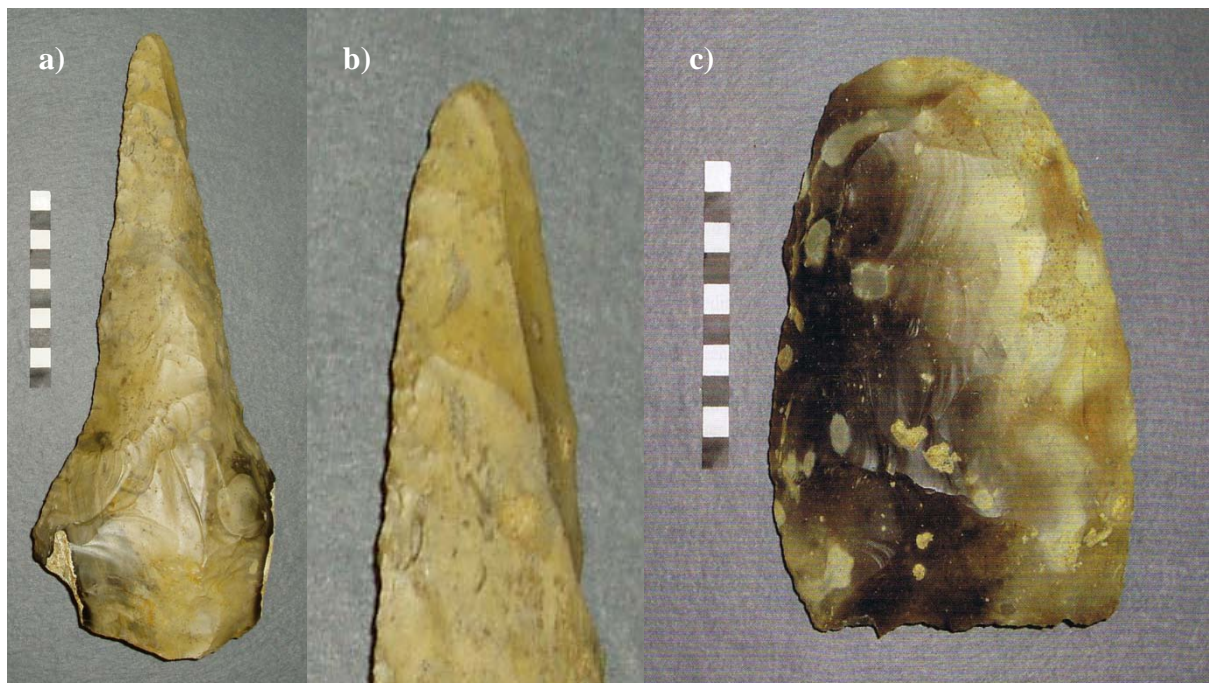


Figure 7. 9: Newly discovered Cuxton ficron (a) with enlarged view of tranchet removal on tip (b). Image courtesy of FWS. Cuxton cleaver with tranchet removal (c) (Image taken from *Lithics* 25 (2004), 16).

White (2006) comments that most cleavers are made on handaxes with convergent edges with a round tip removed through resharpening. He also contends that the whole idea of cleavers in the British Palaeolithic may be moot as they could simply be the by-products of tranchet sharpening of the tip. This is evidenced distinctly at Boxgrove where tranchet sharpening is common. I would suggest that the photographic examples presented above (Figures 7.8-7.9) which are metrical ovates (Roe, 1968), could easily have supported a pointed tip before resharpening. Metrically speaking, the added length, pre-tranchet removal, would almost certainly have led to their reclassification under the Roe (1968) schema as points. The handaxe in Figure 7.8 also supports a cleaver tip in the tradition sense of the term (Tixier, 1957).

The impact of tranchet removals on Roe's (1968) scheme provides a large problem for the McPherron (1994) argument. By using Roe (1968) as the basis for his critique of the Raw Material hypothesis (White, 1995) he is missing a large proportion of the variability caused by the very reduction techniques he is trying to examine. The above evidence would suggest that reduction through resharpening can be demonstrated at the British Lower Palaeolithic site of Boxgrove, but that it cannot be accessed through the application of McPherron's model using Roe's metrical classification.

These observations also lead to the conclusion that it appears to be nearly impossible to clearly identify a preferred form in the archaeological record, as even the largest, best quality handaxes at Boxgrove have been discarded in a state of partial reduction, indicated by the large amount of potential utility still remaining in these handaxes, which renders their original form almost undetectable. A rare exception can be found

in reconstructed reduction sequences from refitted debitage, such as that found at the horse butchery site, GTP17, at Boxgrove, where the initial intended form can be reconstructed from the products of reduction into a large ovate (Figure 7.10, below). The reconstructed sequence preserves the switch from hard to soft hammer but does not show the finishing of the piece and, as such, no tranchet flakes (Roberts and Parfitt, 1999).



Figure 7. 10: Refitted knapping sequence from Boxgrove (Image courtesy of M.Pope)

This discussion on the effects of tranchet removals has examined one of the most visually obvious potential impacts of resharpening on handaxes at Boxgrove. It remains to look at the rest of the assemblage both visually and metrically, with the aim of identifying other aspects of resharpening evidence.

7.2.3 RESHARPENING AT BOXGROVE

There is an image of the ‘typical’ Boxgrove handaxe in the minds of all researchers familiar with the site which conforms to Ashton and White’s (2002) notion of an ideal handaxe (Figure 7.11, below). The ideal Boxgrove handaxe is refined,

comprehensively worked and shaped with soft-hammer reduction, retains only small amounts of residual cortex and has a high level of symmetry in planform.



Figure 7. 11: ‘Typical’ Boxgrove handaxe. (Image courtesy of M.Pope)

This is the type of handaxe which is used almost exclusively in publications and presentations about the site and is synonymous with the pinnacle of Acheulean craftsmanship. There are however a range of handaxe forms represented within the Boxgrove assemblage, as demonstrated in Chapter 5. The handaxes pictured below (Figure 7.12) represent some of the non-typical handaxes in the Boxgrove assemblage which do not conform to the notion of a well-made ovate handaxes, they lack the basic components of preferred form, have irregular edges and a general lack of symmetry. Whilst these would pass for well made examples in some of the more varied assemblages in the present study, why they occur in the Boxgrove assemblage where more ‘typical’ forms are commonly produced, remains to be demonstrated.

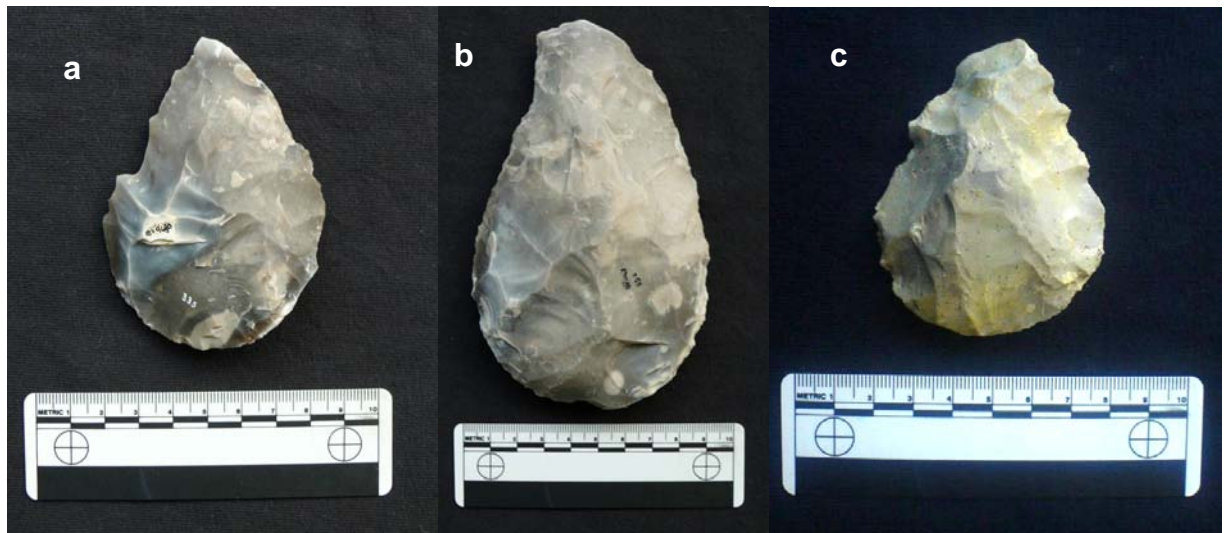


Figure 7. 12: Three non-typical Boxgrove handaxes (Photos: M.Pope).

Most important of all, two of the three examples above (b and c) would be classified as points on metrical criteria, which is not a form expected at Boxgrove under the raw materials hypothesis (White, 1998a). Several further insights into the processes occurring at Boxgrove can be gained by returning briefly to metrical analysis and looking in more detail at the distribution of planform and refinement.

Firstly, instead of looking at overall refinement based on the location of the maximum thickness, and taking into account McPherron's (1995) assertion that resharpening is occurring at the tip of the handaxe, the ratio of tip refinement was calculated for the Boxgrove handaxes. This is easily achieved as two of Roe's (1968) measurements are the width of the handaxe at $4/5^{\text{th}}$ length and the thickness at the same point. The aggregated results from Boxgrove are as follows:

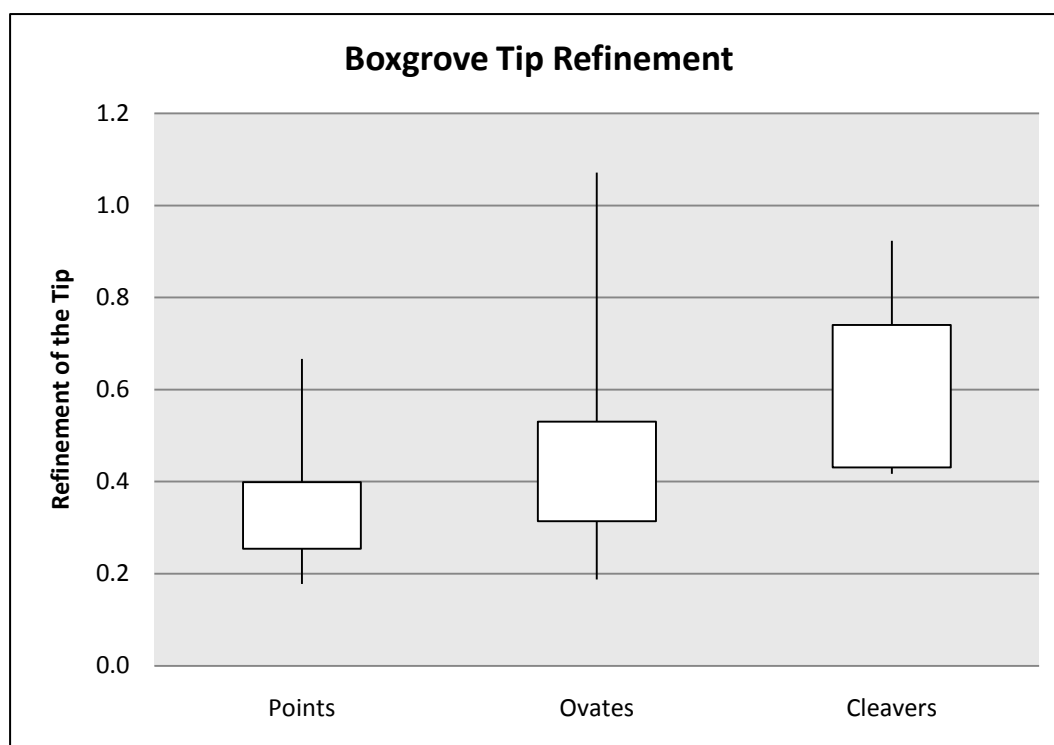


Figure 7. 13: Tip refinement range and trends of Boxgrove handaxes.

Figure 7.13 indicates that there is a central tendency in the Boxgrove assemblage for handaxes with longer tips (points) to have more refined tips than handaxes with shorter tips (ovates and cleavers). As with all of these measures, there is a degree of variation inherent in the extremes, particularly for ovate handaxes. More refined pointed handaxes are contrary to the expectations of the raw material hypothesis (White, 1998a) which would expect pointed handaxes to have thicker and less refined profiles. Subsequently, the relationship between butt and tip refinement was examined (Figure 7.14, below) and showed that, regardless of length, the butt and the tip showed different patterns of refinement. Butt refinement remained relatively static across the range, whilst tip refinement was far more varied. The most obvious conclusion from this is that the tips are more varied as they are being modified by resharpening which results in a wide range of tip forms. The butts of Boxgrove handaxes remain static regardless of length as they remain unmodified by the resharpening process. This conclusion gives support to the basic tenet of

McPherron's (1995) theory that handaxe tips are the modified component of the resharpening process.

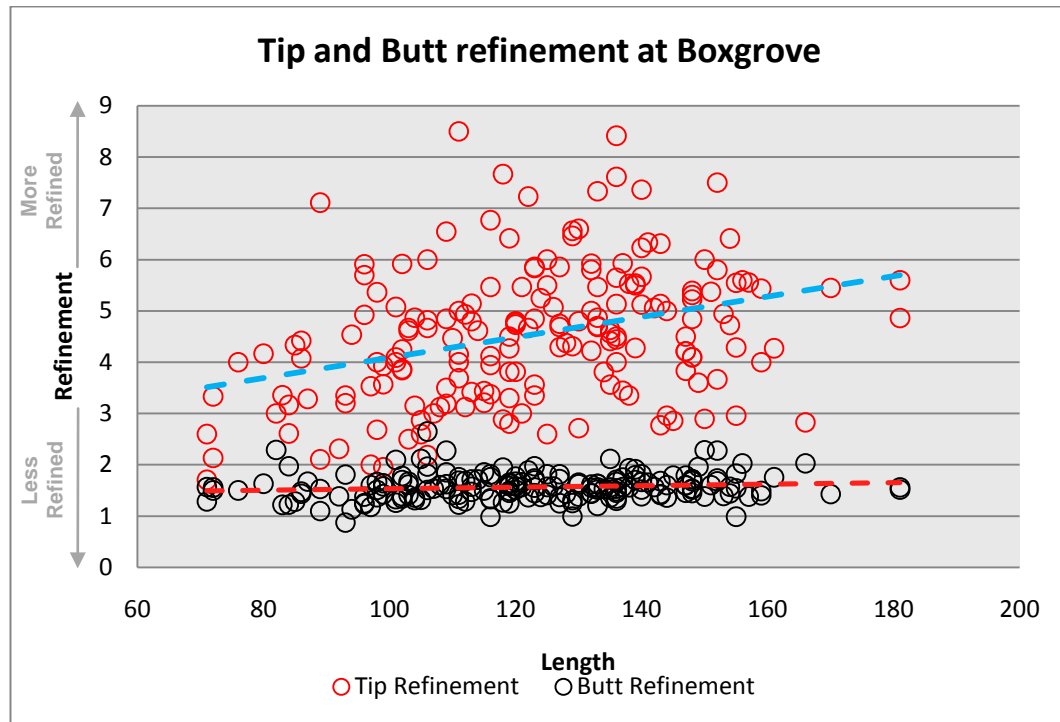


Figure 7. 14: Tip refinement (red) is contrasted with butt refinement (black) for the Boxgrove assemblage.

It is now possible to begin to form an idea of the type of resharpening occurring at Boxgrove, which is typified by tranchet removals and centred on the tip. Such resharpening produces a range of forms, although the general trend is towards the point/ovate divide – creating a tip that is 65% of the total length. This summarises the metrical and visual observation of the handaxe assemblages. However, research undertaken by Pope (2002) indicates that there is also evidence for resharpening in the spatial distribution and patterning of handaxes at Boxgrove.

Pope (2002) studied the distribution of lithics together with the refitting and discard patterns across the site. He found evidence for lithics being transported around the site, primarily indicated by a lack of association between the debitage from handaxe manufacture and the handaxes themselves. There are eight refitting sequences at

Boxgrove which can be linked to varying stages within the use-life of a handaxe from roughout to completed handaxe (Pope, 2002). The most informative of these refitting sequences is the modification of a handaxe which had been shaped into an ovate form, transformed through the removal of two consecutive tranchet removals from the tip.



Figure 7. 15: Handaxe with consecutive tranchet removals refitted to the tip (Image courtesy of M.Pope).

Pope (2002) was unable to match a handaxe to a refitting group, demonstrating that handaxes which had been modified onsite had been removed, and in contrast, handaxes discarded onsite could not be matched to refitting debitage, indicating they had been produced elsewhere. This shows a complex pattern of manufacture, use, resharpening and possible reuse resulting in transport and discard in other locations either within the Boxgrove landscape or further afield. Landscape evidence supports the assertion that resharpening is impacting not only on form but also on the patterning and distribution of archaeological signatures at sites such as Boxgrove.

7.2.4 RESHARPENING AT BOXGROVE SUMMARY

The above discussion has touched upon several aspects of resharpening that can be shown to be impacting on the final form of the assemblage at Boxgrove. Fundamental to the argument is the observation that even the largest handaxes exhibit evidence of resharpening, mostly in the form of tranchet removals. This is important for two main reasons: firstly, it shows that the initial form of handaxes is lost in the majority of cases; secondly it indicates further limitations of the point/ovate/cleaver terminology (Roe, 1968), particularly the notion that metrical cleavers are a type in their own right (White, 2006). The realisation that we are only seeing form as reflected at the point of discard should inform us that there needs to be a shift in the way in which we categorise and conceive of variation in handaxe form. Landscape evidence reveals that resharpening had an impact on the distribution and patterning of handaxes and debitage within the landscape (Pope, 2002). The above discussion has not considered why handaxes were being discarded at various points along the use-life pathway and this topic will be returned to later. Combining landscape and metrical/visual analysis has demonstrated that resharpening can radically alter form, making it one of the primary causes of variation in handaxe shape.

There is insufficient evidence to suggest a rejection of the theory that the creation of differentially shaped handaxes occurs primarily through the approaches to variable raw material size and quality. The maximisation of the edge length and other prehensile qualities does appear, from Ashton and McNabb (1994) and White's (1998a) research, to be the intention of the knapper when dealing with the initial creation of a handaxe from a roughout or a nodule. However, by its very nature, their

methodology can only be replicated on handaxes with diagnostic cortical remnants being present, or from the reconstruction of a knapping sequence through refitting. The latter is incredibly rare, even at Boxgrove, where the ovate handaxe produced from a long refitting sequence has been removed (Austin, 1994). It can be argued that diagnostic remnant cortex is most likely to be found on handaxes that have been discarded in the initial stages of bifacial reduction, as cortex is removed through resharpening. Both papers found that more handaxes which fell in the ‘pointed’ grouping retained sufficient cortex to allow original blank reconstruction. This is undoubtedly due to the greater proportion of cortex remaining on an unworked butt. Yet a handaxe with an unworked butt could still have undergone resharpening. Therefore it can be argued that the conclusions of both papers (Ashton and McNabb, 2004; White, 1998a) are only directly applicable to handaxes that are either in the early stages of reduction or which have been constrained so heavily by the raw material that they couldn’t be reduced further. In White’s (1998a) paper, the maximum percentage of handaxes from a single assemblage where the original blank could be determined was 35% and at Boxgrove this was only 4%. The above discussion also indicated that we are dealing with the discarded component of an assemblage. What if the handaxes that are discarded at point-dominated sites simply reflect *ad hoc* creations of expediently produced handaxes along the route of least resistance (as indicated by the smaller number of removals on the pointed handaxes in White’s assemblages)? The handaxes which have greatest potential for further reuse may have been removed from the site, transported around the landscape and discarded sporadically as part of the filtering of the archaeological record through behavioural selection.

It appears that enough doubt can be cast upon the principles of the Raw Materials hypothesis in relation to the impact of raw material on final form, whilst not discounting that the initial decisions made by a knapper are conditioned by the size and quality of the raw material. If resharpening is identified as the primary factor influencing the variation in the final form of handaxes, it is necessary to outline the trajectories that this might take. The use of tranchet removals on the handaxe tip was the primary trajectory at Boxgrove, but it is not the only trajectory that was evident in the wider dataset. The following section will outline some of the potential trajectories that were observed on other handaxes in the Boxgrove assemblage and the other sites in the dataset, and in doing so will seek to address some of the more widely identified outcomes, namely twisted ovates, plano-convex and bout coupé handaxes.

7.3 TRAJECTORIES OF RESHARPENING

This section will identify a set of trajectories of resharpening that can be inferred from the resultant end products of resharpening sequences found within my dataset. Inevitably, there will be other trajectories which have not been used within the sites in the study group and possibly those which have been obscured by subsequent episodes of resharpening. However, the outlined trajectories will be structured in such a way as to encompass a variety of possibilities and also to allow room for expansion in the future. These trajectories will form the basis of the model for resharpening outlined in the next section.

7.3.1 BIFACIAL TIP REDUCTION

The tip reduction trajectory is familiar from the observations made in the previous section, as it is the most common form of resharpening at Boxgrove. Typically this trajectory uses transverse tranchet blows to reduce the tip, maintain a sharp edge at the tip and rejuvenate the edges. The butt of the handaxe is unworked and the reduction method results in the changing shape of the handaxe through the decreasing ratio of tip to butt. The knapping strategy involves removing flakes from both sides of the tip so as to maintain an even profile, which keeps the balance of the two faces of the handaxe. This is the trajectory of resharpening envisaged by McPherron (1995) although, unlike his model, it does not assume that a pointed handaxe is reduced into a more rounded one. The following diagram illustrates how a handaxe can be resharpened in this manner:



Figure 7. 16: Hypothesised resharpening trajectory where the tip is reduced.

Figure 7.16 shows one possible outcome of the tip reduction resharpening trajectory, one that assumes that the edges are also altered slightly as a part of this process as well as the tip. The purpose of resharpening in this manner may also be to maintain convex edges which have been shown to be more productive in use, requiring less resharpening throughout the period of use (Collins, 2008).

In practice, the method is unlikely to result in as smooth a profile as that shown in Figure 7.16 due to the idiosyncrasies of flint knapping, as demonstrated in the Figure 7.17 (below). As hypothesised above, the likely purpose of tranchet removals is to rejuvenate the edges and tip of the handaxe for reuse. At Boxgrove, a number of handaxes with tranchet removals were discarded in the early stages of resharpening with only one or two removals from the tip. They exhibit great potential utility for further reduction, yet have been discarded, behaviour which may have been influenced by the abundant raw material availability.



Figure 7. 17: Boxgrove handaxe with irregular tip due to tranchet removal (Photo:KE)

Where tranchet removals result in the irregular tip edge seen in Figure 7.17 the integrity of the straight cutting edge is impaired along with its symmetry, two of the key features of White's (1998a) preferred form. A further resharpening trajectory seen on handaxes from Boxgrove is outlined below:

7.3.2 BIFACIAL EDGE REDUCTION

The bifacial edge trajectory is also focussed on the tip of the handaxe but is concentrated on the modification of edges and so impacts on width more than the reduction of length (unlike the previous trajectory). Convergent reduction occurs along the edges of the tip and so the tip becomes relatively more pointed. Convergent reduction can be achieved through the use of obverse tranchet removals as with handaxe a) in Figure 7.18 (below). It can be used as a method for maintaining a long cutting edge when the raw material is intractable or perhaps where tip reduction has proceeded through tranchet removals until it is not practical to continue reduction in this fashion due to the increased thickness at the base. Following this, the reduction can continue if the remainder of the tip is then reduced from the sides, as with handaxe b) in Figure 7.18:



Figure 7. 18:
Boxgrove
handaxes with
bifacial edge
reduction
(Photo: KE).



Figure 7.19 (below) shows one possible bifacial edge resharpening trajectory and illustrates the lesser impact on length and butt/tip ratio that such a trajectory has

compared to the tip reduction method. This lesser impact means that it would be more difficult to see patterning in planform figures related to bifacial edge resharpening. It also indicates a trajectory towards either more pointed forms as the reduction of the edges pushes the position of maximum width closer to the base of the handaxe, or towards a static planform figure if the ratio between length and width is maintained.



Figure 7. 19: Hypothesised resharpening trajectory where the edges are reduced.

7.3.3 UNIFACIAL TIP REDUCTION

Another possible resharpening trajectory that also involves the reduction of the tip comes under the heading ‘unifacial tip reduction.’ As the name implies, the tip is reduced but only from a single face. Again, tranchet removals are a possible method of resharpening. The benefit of this particular technique is that it maintains the length of the handaxe whilst keeping the tip thin. This inevitably leads to a relatively steep angle between the tip and the butt, with the weight of the piece becoming centred in the butt:

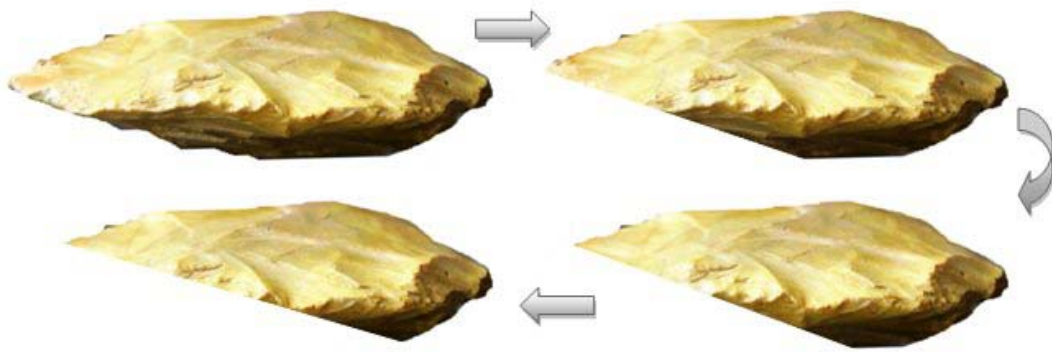


Figure 7. 20: Hypothesised resharpener trajectory where the tip is reduced unilaterally.

As with the previous trajectory, unifacial tip resharpener would be difficult to pinpoint using the traditional methods of metrical classification. The length of the handaxe is reduced relatively slowly compared to the overall volume of the piece. Maximum width and thickness will be affected but this may not occur till the later stages of the trajectory dependant on their original location. The handaxe in Figure 7.21 is an example which has been substantially reduced using the unifacial tip trajectory. It is only possible to speculate as to the original dimensions of this handaxe, although the direction of the original edge is visible at the butt. What is interesting about this particular handaxe is that the resharpener method has produced what can only be described as an incipient twisted profile:



Figure 7. 21: Bowman's Lodge handaxe that has been unilaterally reduced at the tip (Photo: KE).

7.3.4 UNIFACIAL EDGE REDUCTION

The unifacial edge trajectory focuses on one or both edges and reduces them from a single face. Unlike the bifacial version the impact is primarily in profile, not in plan, and particularly at the intersection of the two faces of the handaxe. Figure 7.22 shows the view from the side of a handaxe which is then reduced unifacially along the edges. The red line shows the impact of the resharpener on that face as the widest point of the handaxe in profile goes from the centre (a) to the base (c). Unifacial edge reduction can occur around the whole circumference of the handaxe if the shape does not preclude it.

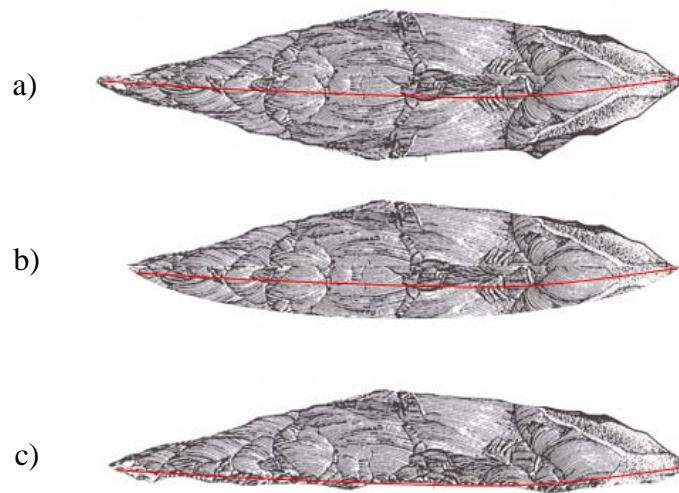


Figure 7. 22: Diagram representing a handaxe that is being unifacially reduced from the edge (Illustration modified from Ashton, 2001, 202).

This type of trajectory, depending on the primary location of resharpener can impact on length, width and thickness to a lesser extent. Resharpener along the length would lead to a more elongated planform, whilst along the tip and butt would lead to a squatter shape. It would also be possible to maintain the ratio between length and width as the handaxe is reduced, were all edges reduced equally.

The profile change illustrated in Figure 7.22 is reminiscent of a form that is part of a number of assemblages in my dataset. Plano-convexity is especially prevalent at Wolvercote (Figure 7.23) and it is plausible to suggest that plano-convex handaxes can result from resharpening. In the case of Wolvercote, where good quality raw material is scarce, unifacial edge resharpening could be indicative of the extension of the use-life of a piece and the maintenance of a straight all-round cutting edge with a practical working edge angle.



Figure 7. 23: Plano-convex handaxe from Wolvercote – possibly a result of unifacial edge reduction.

7.3.5 TWISTED REDUCTION

As demonstrated above an incipient twisted profile can be created from a unifacial tip reduction strategy but this does not explain the presence of fully twisted handaxe profiles at sites such as Hitchin. Most trajectories illustrated above are, either by design or necessity, focussed on the reduction of the tip and the edges of the handaxe but the reduction of the butt rarely occurs. However, if the unifacial tip resharpening trajectory was extended to incorporate the butt, it is possible to show how a twisted handaxe could be produced through resharpening.

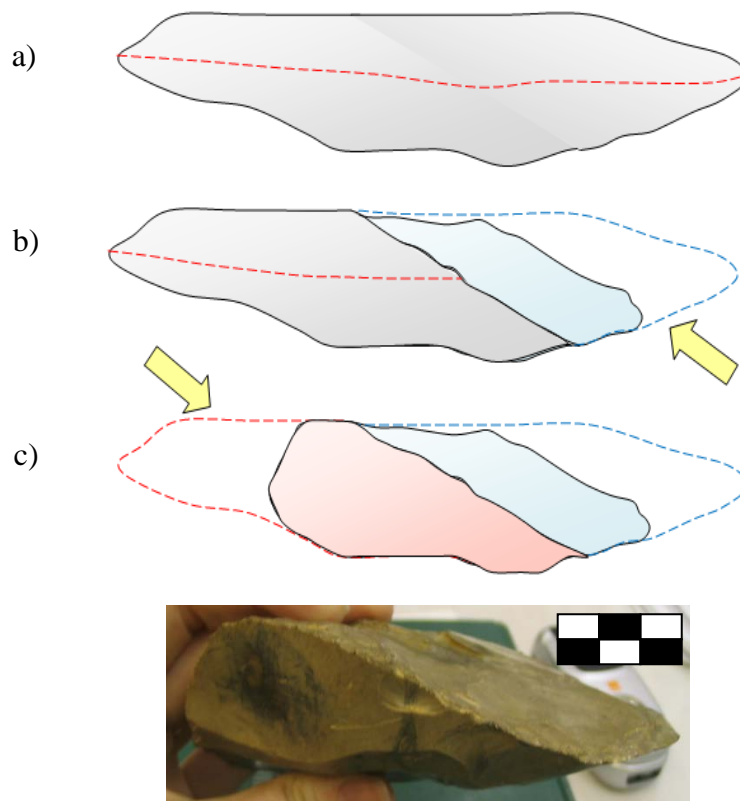


Figure 7. 24: Unifacial reduction of the tip and butt resulting in a twisted handaxe profile. Yellow arrows indicate the direction of knapping.

The above diagram shows the stages of reduction that could produce the twisted profile as shown in Figure 7.24. Firstly the handaxe is reduced unifacially at the tip (b), then from the opposite face at the butt (c). This intensive reduction, only extensively seen in the Late Lower Palaeolithic (White, 1998b), may explain why the twisted ovate handaxes in my dataset consistently had the highest numbers of removals in the edge patterning and may represent a new approach to resharpening which extends the use-life of a handaxe through the incorporation of the butt into the resharpening trajectory.



Figure 7. 25: Twisted ovate handaxes from Hitchin (Photos: KE).

7.3.6 BOUT COUPÉS – A MOUSTERIAN RESHARPENING TRAJECTORY

When considering the metrical differences between Acheulean and Mousterian handaxes in Chapter 5, I noted that pointed handaxes at Lynford were dissimilar to the majority of Acheulean pointed handaxes and that planform was the sole measurement which appeared to show a genuine difference between Lynford and Boxgrove handaxes. This led me to return to the handaxes from Lynford and particularly to those which had a tip length of 75% or more of the total length. Many Mousterian handaxes with this profile are labelled as bout coupé handaxes, although there are many other forms which also present a tip-heavy ratio.

The photographs below show four Lynford handaxes which metrically have tip lengths of approximately 80% of the total length of the handaxe:



Figure 7. 26: Lynford handaxes (40548, 40000, 40017, 40170) which have points of maximum width close to the base.

In contrast to other points that have been pictured in the course of this thesis, the handaxes from Lynford retain little or no cortex and have fully worked butts. Whereas the ‘glob butt’ (Gowlett, 2006) in many pointed Acheulean handaxes is used to balance the tip, the handaxes in Figure 7.26 are almost all tip and weight is distributed across the piece more evenly. What is not visible from this montage is that they are also markedly plano-convex in profile. The *bout coupé* resharpening trajectory therefore represents an extension of the bifacial edge trajectory in that the majority of the handaxe is resharpened into a continuous convergent edge. This is coupled with unifacial edge reduction which thins the handaxe on one face only. This technique is particularly effective at maximising both the length of the handaxe and the length of the bifacial edge, and can be applied to handaxes made in either a pointed or ovate initial form. The unifacial reduction which results in plano-convexity also ensures that the handaxe does not become too heavy and thick in relation to its overall size.

7.3.7 SUMMARY

The trajectories outlined above can be seen as a starting point for understanding resharpening and the impact that it can have on handaxe form, both visually and metrically. These trajectories are by no means an exhaustive list of possibilities: they reflect the resharpening techniques most obviously utilised on handaxes in the dataset. The discussion of resharpening trajectories attempted to impart the transformational potential of resharpening sequences in order to stress the importance of resharpening as an influence over variation in planform. Dynamic changing form in handaxe manufacture makes it more important than ever to consider the use-life of a handaxe when classifying and explaining variability. The

following section contains an outline of a new model for labelling and measuring variability which incorporates resharpening as a key factor.

7.4

RECONSIDERING ROE

In the present chapter I have outlined the basis for promoting resharpening as the primary factor causing variation in final handaxe form. This has been achieved through the observations and calculations made on the Boxgrove assemblage and also through the identification of several possible resharpening trajectories. I now need to address the gap which is left by the discounting of Roe's metrical scheme as a valid methodology for classifying variation. It is clear that regardless of the initial intention, the labels of 'Point', 'Ovate' and 'Cleaver' have become typological markers and that the semantic connotations of these terms has led to confusion, particularly as the terms relate solely to the position of maximum width, not to shape. The research outlined above has indicated that the relationship between the tip and the butt is key to interpreting handaxe variation through the application of a model of resharpening.

7.4.1 INTERPRETING ROE AND RESHARPENING

If we return to the figure showing the relationship between planform and length, (Figure 7.1, reproduced below as Figure 7.28) it is clear that it cannot be interpreted on the basis of a changing relationship between length and shape as it has been demonstrated that planform only describes the relationship between length and position of maximum width.

It appears that a rethink is necessary to change the way the relationship between length and shape is defined without resorting to loaded terms such as ovate and point which are shape-specific in order to avoid the pitfalls associated such terminology. If we define the tip and butt as the area above and below the point of maximum width, using the ratio between the two as a measure of planform and we accept McPherron's (1994) description of this as a measure of tip length over butt length, then the natural terminology to use would be to describe handaxes as butt-centric versus tip-centric, with tip/butt balanced as the intermediate form. The following diagram (Figure 7.27) demonstrates these possibilities, deliberately using a rectangular outline to distance them from the notion of shape.

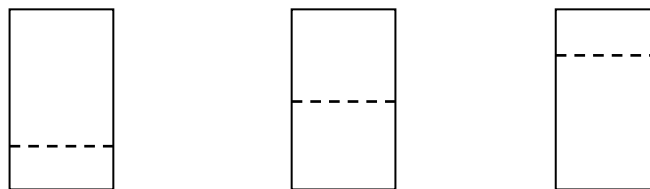


Figure 7. 27: Three possible locations of maximum width (25%, 50% and 75%)

Handaxes which were tip-centric would have the location of maximum width in the bottom 50% of the handaxe, a centred maximum width would indicate a balanced butt/tip ratio and a maximum width in the top 50% of the handaxe would indicate tip-centricity. However, as Figure 7.28 (below) demonstrates, this would group the vast majority of Boxgrove handaxes into the tip-centric grouping due to the lack of variation at this site. In fact, 95% of tip lengths at Boxgrove are contained between 25% and 50% of total length, although it should be noted that this will not be the case at all sites. It is arguably an imperative to include the scale of variation within any new terminological scheme as this has been sadly lacking in other schemes. One of McPherron's (1995) key criticisms of the British tripartite division was that it obscured variation. As demonstrated in Chapter 4, box-whisker diagrams are very

effective at visually displaying variation with reference to the range of variation relative to the mean and the outlier values. They are also easy to produce using commonly utilised statistical programs.

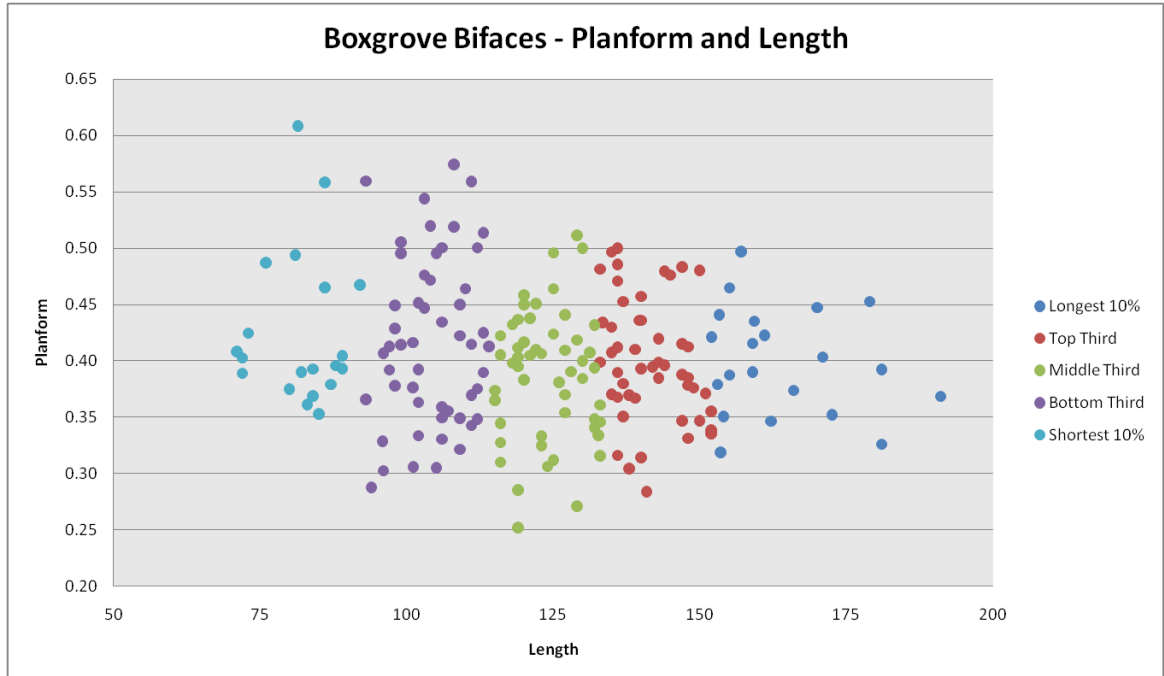


Figure 7. 28: Boxgrove handaxes – comparing length to planform and divided into five length groups.

With the distribution of handaxes at Boxgrove in mind, and the fact that Roe (1968) obviously chose the values of 0.35 and 0.55 for a reason, although this reasoning is unclear, it would seem plausible to incorporate these figures in some form in a new terminology. As the issues surrounding Roe's tripartite division are more with the terminology than the measurements and also to facilitate ease of comparison with other datasets, the following scheme was devised, which builds on the tripartite division by adding three more categories that allow greater variability to be displayed:

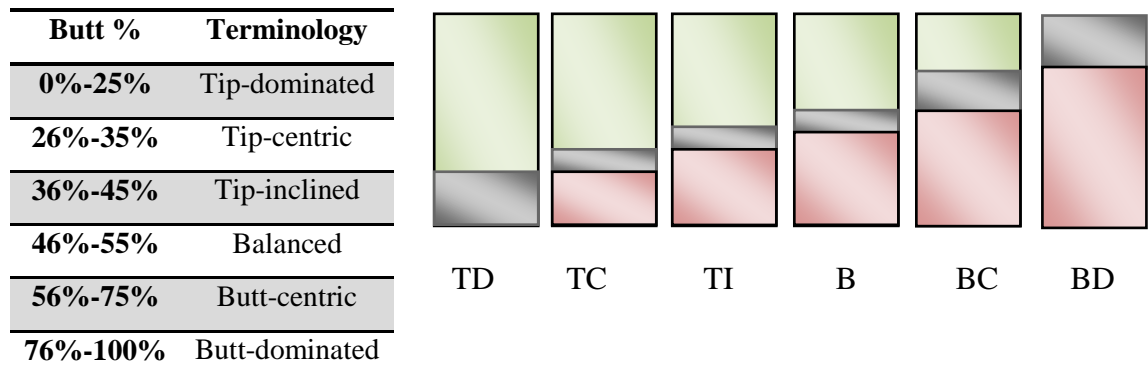


Figure 7. 29; Outline for terminological scheme of tip-dominated to butt-dominated handaxes. Green indicates tip, red indicates butt and grey indicates the range of possible locations for the maximum width.

Handaxes previously designated as points would be split into two groups to distinguish handaxes that were heavily dominated by the tip – this grouping would separate bout coupé handaxes from other tip-centric handaxes. Equally the previous cleaver grouping would also be split into two categories to differentiate handaxes with extreme butt dominance. Ovates would be classified as either tip-inclined or balanced dependent on how close the point of maximum width was to the midpoint of the length. Initial tests of this terminological split on the three sites discussed in the previous section with the addition of Lynford produced the following results:

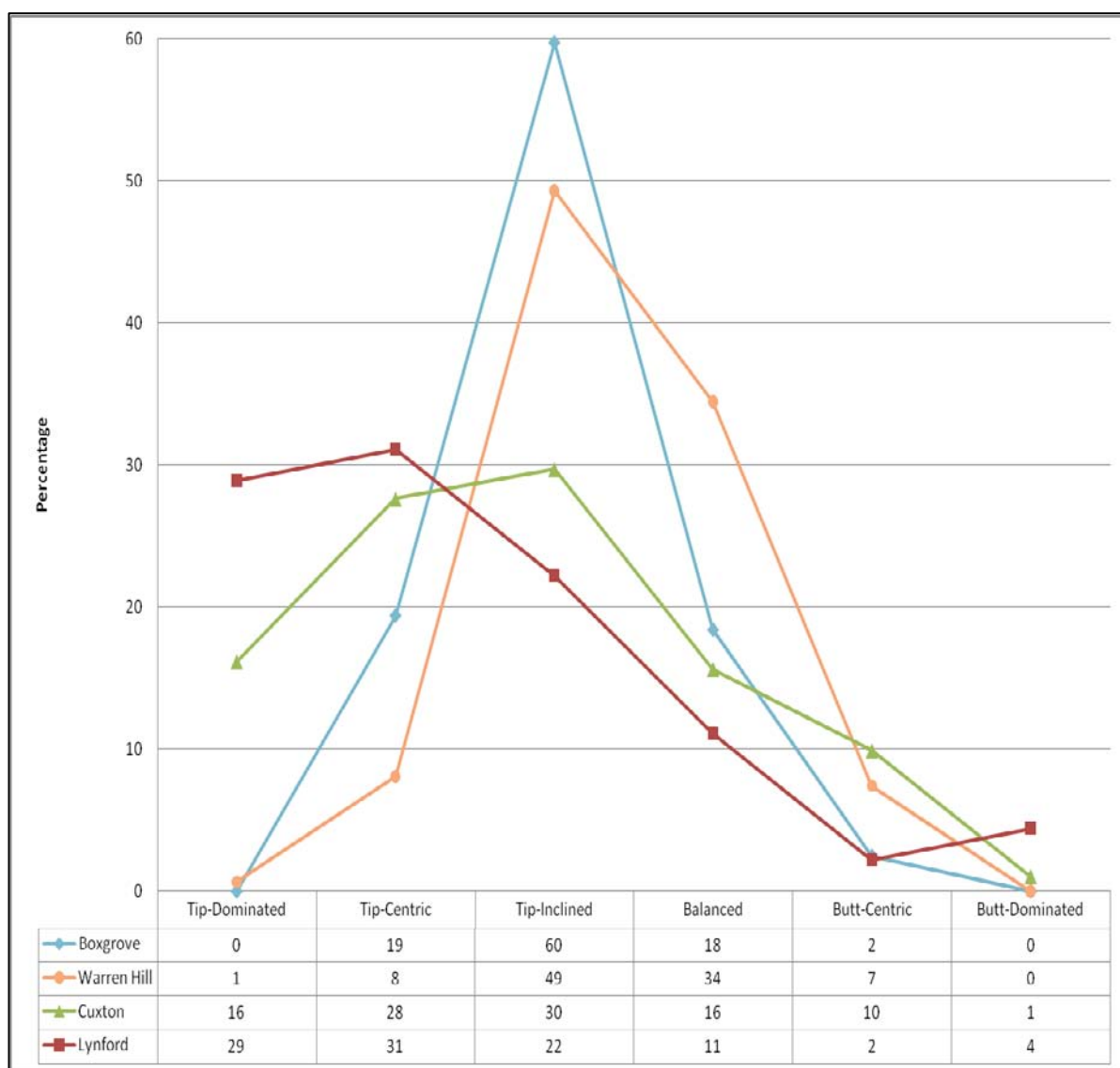


Figure 7. 30: Test graph using the new terminology on four assemblages from the dataset.

The initial patterning showed that there was a distinct difference in the percentage of handaxes in the Tip-Inclined category (between 35% and 45%) with Boxgrove and Warren Hill showing between half and two thirds of handaxes falling within this single category. Lynford and Cuxton showed a more distributed pattern, sharing two thirds between two different categories. Lynford was the only site to show an increase of handaxes into the Butt-Dominated category and together with Cuxton has a large percentage of Tip-Dominated handaxes as opposed to only one between Boxgrove and Warren Hill. Figure 7.31 (below) shows the same sites, but uses Roe's

(1968) tripartite division. Although the overall patterning is the same, there is much less subtlety in Figure 7.31 which makes a simple statement as to whether a site has more points than ovates.

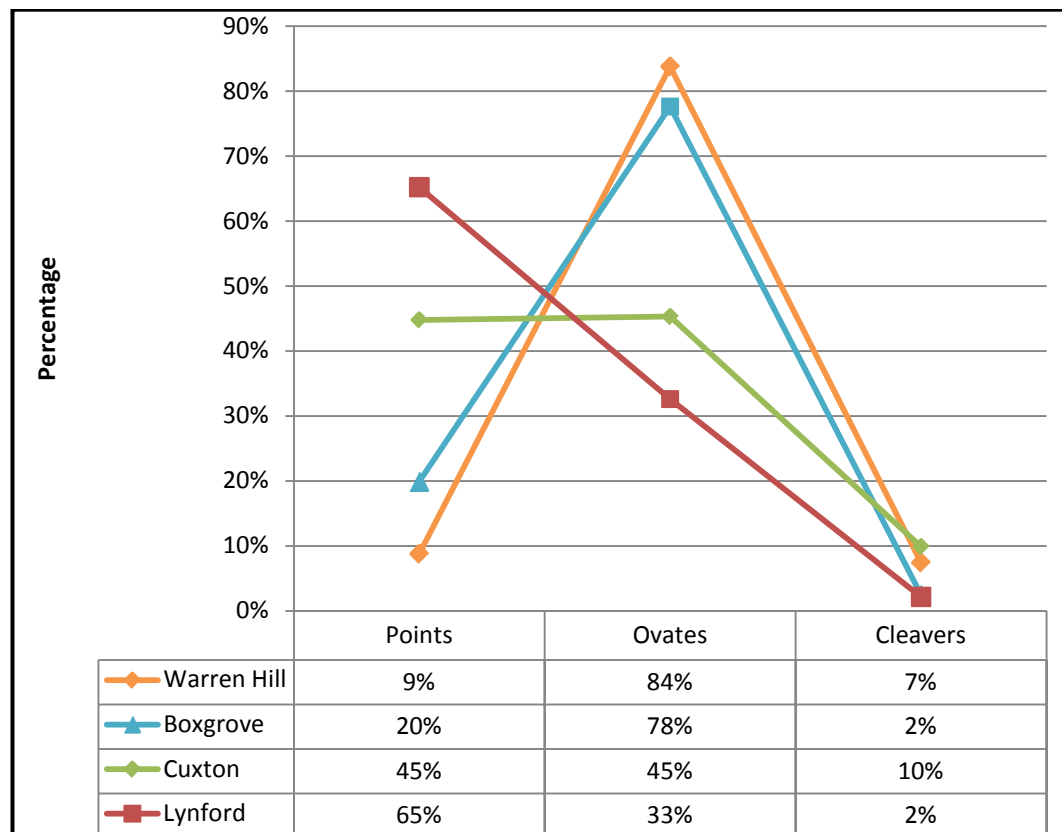


Figure 7. 31: Comparative graph using Roe (1968) terminology.

Encouraged, I added in the rest of the sites, with the exception of those with too few handaxes (Figure 7.32, below):

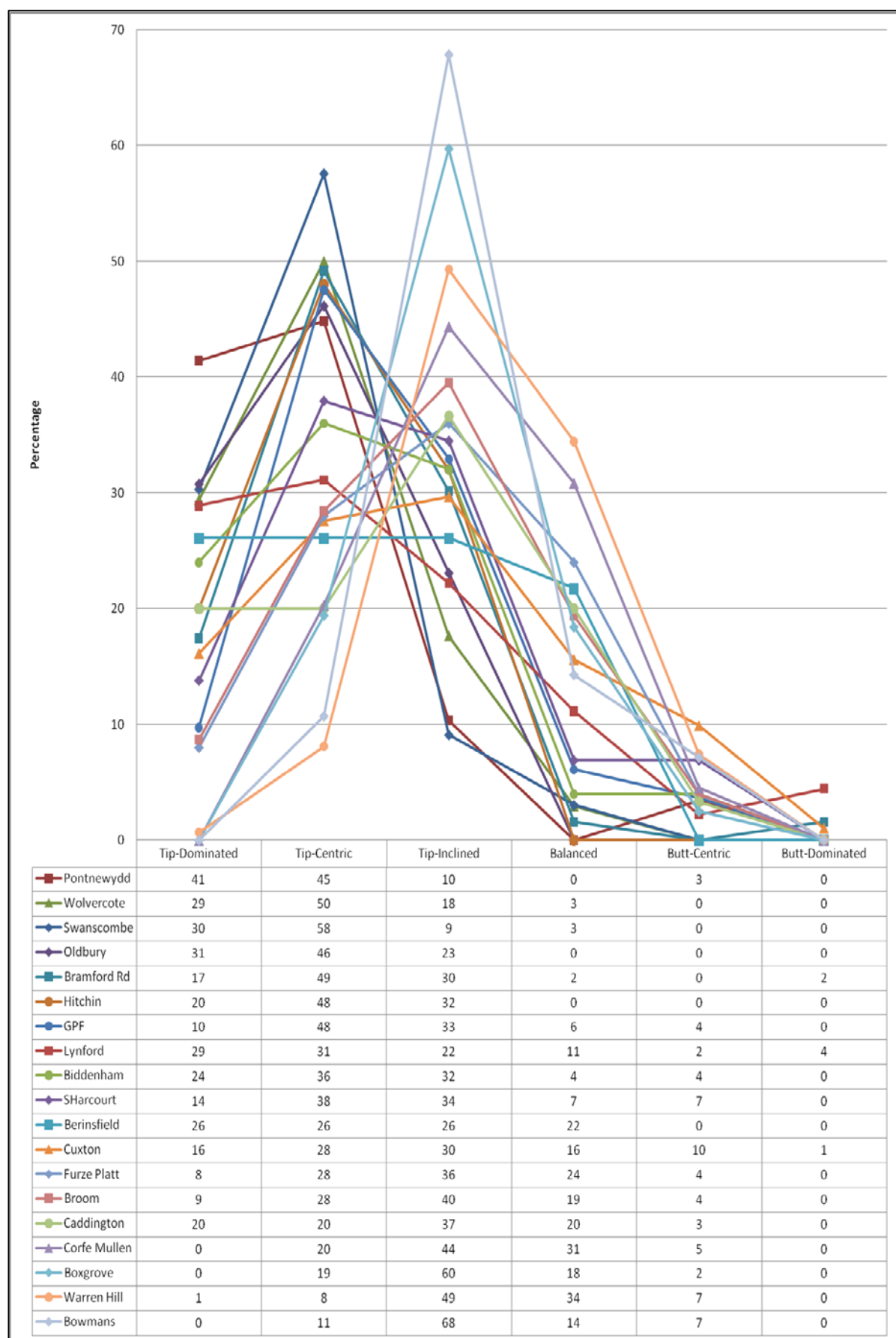


Figure 7. 32: Distribution of handaxes for all the large to medium sites in the dataset.

Again, amongst the data it appeared that there was a partial bimodal distribution that echoed the pattern from the first four sites, so I separated the assemblages with similar patterns, resulting in the creation of three diagrams: one with a Tip-Centric dominant profile, a second with a Tip-Inclined dominant profile and the third with the more balanced profile, with no clear dominant category:

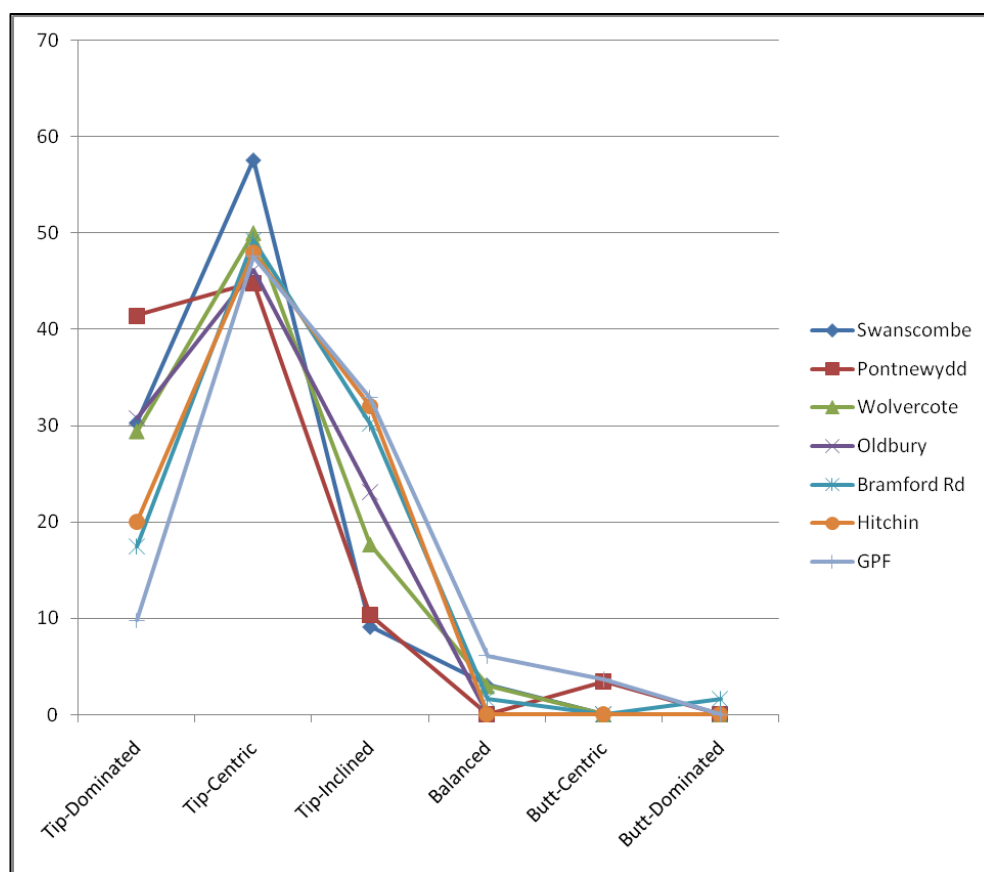


Figure 7. 33: Assemblages dominated by tip-centric handaxes.

The sites in Figure 7.33 have a substantial proportion of handaxes in the Tip-Centric category (between 40 and 60%) in contrast to Figure 7.34 (below) where the sites have between 35% and 70% of handaxes in the Tip-Inclined category. All of the sites in Figure 7.34 are grouped together as they show an increase from the Tip-Centric to the Tip-Inclined category:

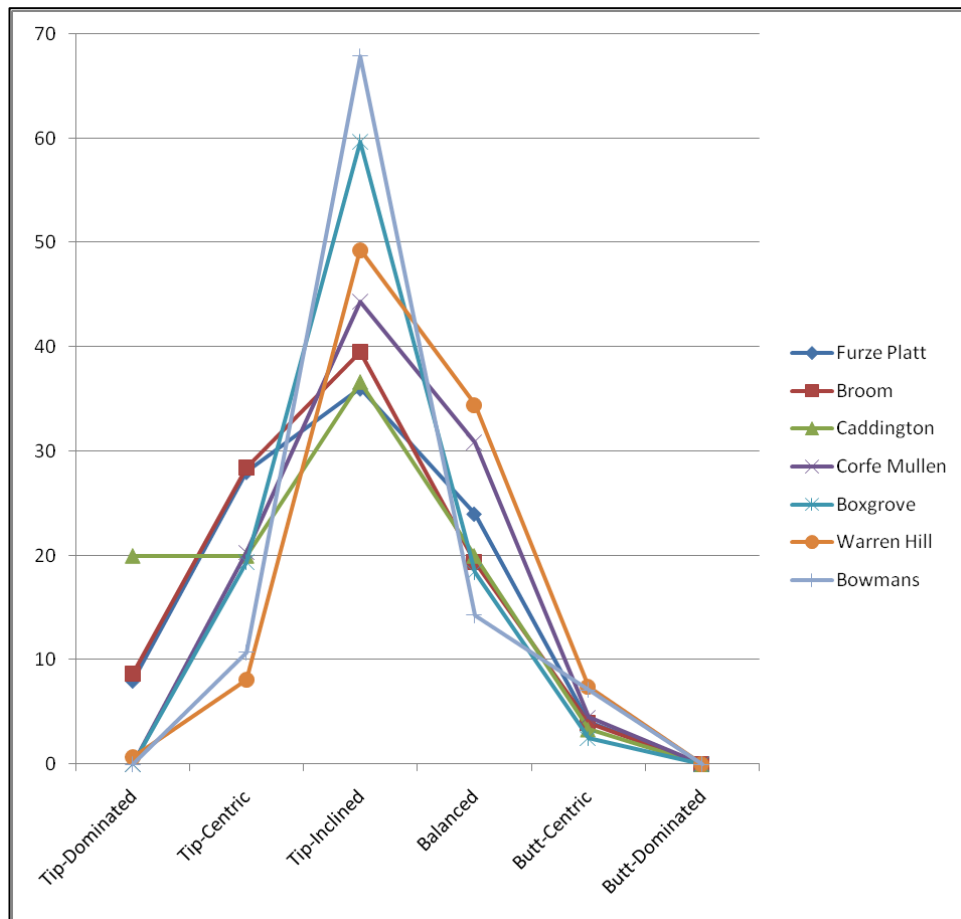


Figure 7. 34: Assemblages dominated by tip-inclined handaxes.

The sites in Figure 7.35 did not emulate either of the two patterns outlined above, instead they do not have a distinctive peak in any category. All of the sites in the dataset show an increase in the percentage of handaxes from the Tip-Dominated category to the Tip-Centric category, and a decrease from the Tip-Inclined to the Balanced category. Only Bramford Road and Lynford show a larger number of Butt-Dominated handaxes than Butt-Centric.

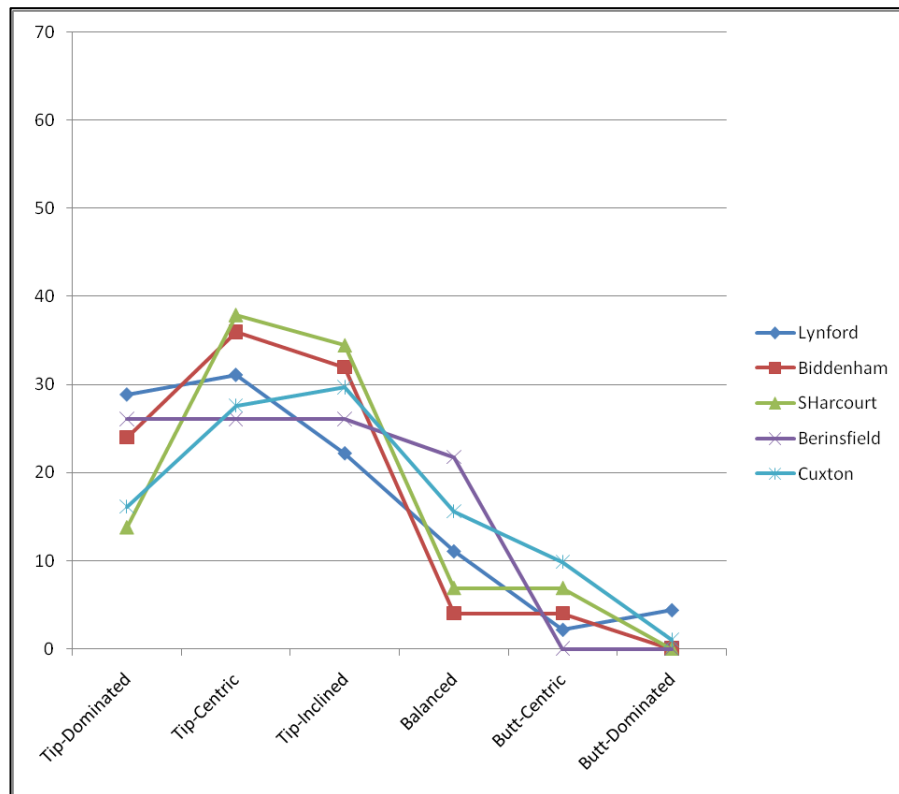


Figure 7. 35: Assemblages not dominated by any one type of handaxe.

Overall, the data presented above suggests a tripartite division of assemblages into those dominated by Tip-Inclined handaxes, those dominated by Tip-Centric handaxes and those demonstrating no particular dominance, conforming well with Roe's division of assemblages into point-dominated, ovate-dominant and intermediate. Table 7.3 shows a basic comparison between the results of the Roe (1968) analysis and the above division. The correlation is good, especially when the sites with only a subset of the total assemblage are taken out of consideration (Furze Platt and Hitchin). A correlation is to be expected as the criteria used to distinguish the groups is the same, although the fact that the tip-centric and tip-inclined groups show the most dominance suggests that extremes of manufacture do not have as much influence in handaxe assemblages. The lack of extreme forms is perhaps why cleaver/butt-dominant handaxes do not form a dominant grouping in any of the assemblages.

	Tip Centric (Pointed)		Intermediate		Tip-Inclined (Ovate)	
	Roe	Emery	Roe	Emery	Roe	Emery
ELP	Hitchin Swanscombe	Hitchin Swanscombe			Boxgrove Warren Hill	Boxgrove Warren Hill
LLP	Pontnewydd Stanton H <i>Furze Platt</i>	Pontnewydd Wolvercote GPF	Wolvercote GPF	Stanton H		<i>Furze Platt</i>
ULP	Cuxton Berinsfield			Cuxton Berinsfield Biddenham	Bowmans Lodge Caddington Corfe Mullen	Bowmans Lodge Caddington Corfe Mullen
EMP			Broom			Broom
LMP	Branford Coygan Lynford	Branford <i>Oldbury</i>		Lynford	<i>Oldbury</i>	

Table 7. 3: Distribution of the dominant type of handaxe in dataset assemblages (**bold**=match, *italics*=Emery dataset smaller).

However, although there are a lack of butt-dominant forms in the dataset, the same cannot be said for tip-dominant forms. Table 7.4 (below) shows the distribution of each type in the dataset:

	Tip Dominant	Tip- Centric	Tip- Inclined	Balanced	Butt- Centric	Butt- Dominant	Total
Handaxes	155	398	550	246	61	2	1412
Percentage	11%	28%	39%	17%	4%	0%	100%

Table 7. 4: Distribution of handaxe types in the dataset.

Whilst there is a good case for amalgamating the butt-centric and butt-dominant categories due the small numbers involved, the division of handaxes at the tip-dominant end of the spectrum has produced a viable extreme category, with 11% of the handaxes in the dataset were tip-dominant, with tips that were greater than 75% of the total length. Although no handaxe assemblage had tip-dominant handaxes as the largest category, the number of handaxes with long tips provides a good argument for keeping the expanded terminology, especially when combined with the greater depth of detail the new terminology gives, as I outlined above.

Earlier in this chapter I discussed the difference in variation in handaxe length between Boxgrove and Warren Hill, with the latter comprising of much smaller handaxes than the former. I was interested to see what impact, if any, length had on the distribution of the six handaxe types outlined above. To this end, I split the two assemblages into the five length groupings from the earlier analysis and compared the frequency of each type of handaxe in these categories. From the patterning visible in Figure 7.32, it appears that there is a difference in the distribution of handaxes within these two assemblages. Warren Hill demonstrates a decrease in the percentage of Tip-Inclined handaxes as length decreases, combined with a concomitant increase in the percentage of Balanced handaxes. Tip-Dominant handaxes are all but absent (one at WH) and neither site has any Butt-Dominant handaxes, demonstrating a lack of extremes. Indeed at Boxgrove, Butt-Centric bifaces are only found in the shortest two length categories whereas they are more distributed at Warren Hill. There is a clear pattern at Warren Hill towards handaxes with relatively shorter tips as length decreases, whereas at Boxgrove, the trend is the maintenance of the Tip-Inclined form, aiming for a balance between tip and butt. This may indicate that Warren Hill handaxes are subject to more resharpening as the tips are relatively shorter or that different resharpening trajectories are favoured which influence the butt/tip ratio in different ways. Whilst this may also be as a result of the maintenance of an allometric relationship between size and weight (Crompton and Gowlett, 1993), there is clearly a different approach to reduction at these two sites that is resulting in a divergent distribution of planforms.

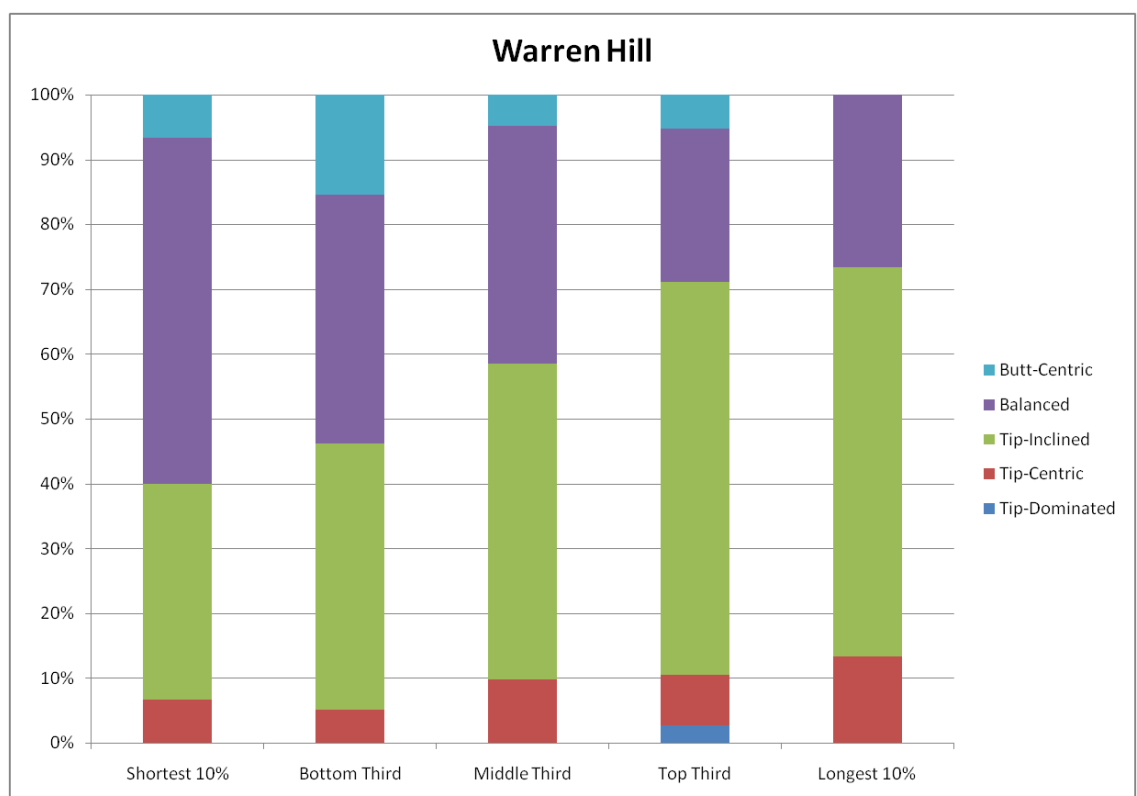
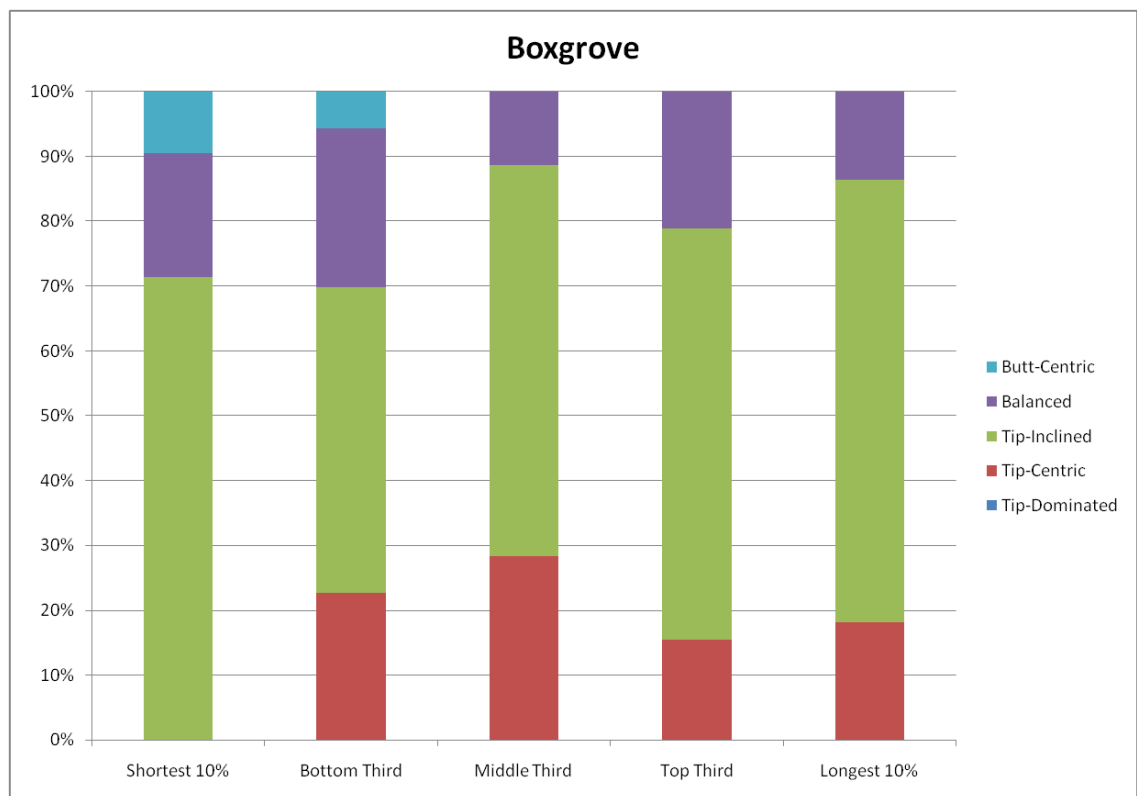


Figure 7. 36: Handaxe type divided by handaxe length.

The preceding section has attempted to provide a new terminology for use when categorising handaxe assemblages and has attempted to show some of the applications of this typology. The terminology of butt- and tip- centricity attempts to distance the researcher from making typological assignments of point, ovate and cleaver without thought as to the semantic connotations of the words. Using the relative dimensions of butt to tip sets resharpening as the basis of the terminology and affords the ability to make inferences regarding the relative proportions of each type in an assemblage. However it does not attempt to explain the variability it describes as there is no quantification of the reduction intensity visited upon each piece. I would suggest that the terminology can be easily combined with a notation as to the presence of tranchet removals and other signs of resharpening together with the use of Wymer's (1964) tip shape categories or a simplified version of that outlined in McNabb and Rivett (2008) in order to give a more representational idea of shape (eg):

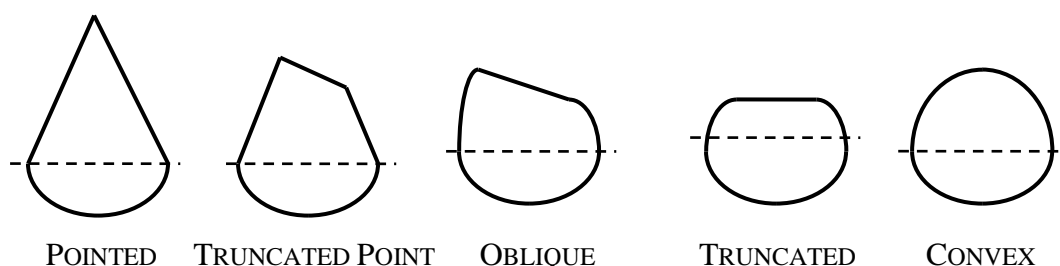


Figure 7. 37: Suggested examples for categorising tip shapes – blue line indicates point of maximum width (adapted from Wymer, 1968 and McNabb and Rivett, 2008).

This combination of recorded variables will allow researchers to compare assemblages and also speculate as to the role of resharpening in an assemblage. When supplemented with a detailed examination of individual artefacts, which looks specifically at identifying resharpening trajectories, the next level of inference can be

achieved which examines the degree to which resharpening is involved in creating handaxe variability. Inherent in the notion of resharpening is the destruction of what went before. Destruction can mean anything from the removal of the tip by a single tranchet blow through to the complete restructuring of an object through intensive resharpening. When attempting to categorise and explain resharpening, the notion of destruction must form an integral part of any understanding and can lead to useful insights when examining why a handaxe was discarded at a particular point in its use-life. The following section outlines a model which uses this approach to explain some of the variation in tip/butt ratios that has been demonstrated in previous sections and chapters.

7.6

THE CONTINUUM MODEL

Resharpening is an active process which recycles, changes and moulds the handaxe throughout its use-life. As a handaxe is resharpened the shape and size are altered as the knapper attempts to maintain the desirable properties of sharpness, balance and a straight, continuous edge. Resharpening is a constant mediation between the intentions of the knapper and the mechanical properties of the raw material. As a resharpening trajectory is pursued the knapper creates a continuum of resharpening within which the shape and ratios of size become fluid and changeable. Handaxes are discarded at many different points along the trajectory from original object to exhausted tool. As researchers we must incorporate the notion that we are dealing with fluid objects which may or may not have undergone episodes of resharpening before discard. Any analysis of handaxe assemblages should work from the basis that the final form upon discard was produced within a continuum of reduction.

The Continuum Model proposes that resharpening is the major element affecting variation in handaxe assemblages from the early Lower Palaeolithic to the late Middle Palaeolithic through the application of varied trajectories of resharpening. Although accepting that raw material plays a key role in the initial decision-making process and primary knapping strategy utilised, the model posits that, from this point forward, the choice of resharpening trajectory is the main influence on the shape and relative proportions of the handaxe and, as such, the identification of these resharpening trajectories and their impact on shape should be a primary aim of the researcher when studying handaxe assemblages. I recognise that in many situations the identification of form and volume that has been lost through successive resharpening episodes may not be possible and as a consequence there is much that cannot be revealed without access to reconstructed knapping sequences. However, each handaxe retains an imprint of any previous form and through the identification of tranchet removals and remnant features from earlier incarnations it is possible to map aspects of the use-life of an individual object.

The relationship between butt and tip plays an integral part in the mediative dialogue between knapper and handaxe, and is something that can be quantified and examined. The continuum model does not propose a direct correlation between tip/butt ratio and a definitive stage in the reduction strategy. As indicated in the current chapter, there are many possible trajectories with which a handaxe could be resharpened that affect the relative dimensions of a handaxe in different ways. However a generalisation that can be inferred is that when the butt of a handaxe is unworked, the ratio between butt and tip becomes more butt-dominant as reduction progresses. The following categorisation takes the types of handaxe proposed in the

previous section and attempts to provide a context for a continuum of reduction between tip-centric and butt-centric handaxes.

7.6.1 TIP-CENTRIC

Handaxes which are tip-centric consist of a tip that is at least 65% of the total length. The model proposed here would see this form as resulting from three potential sources. Firstly, where raw material is particularly poor quality, tranchet reduction may not be a viable option and so the handaxe remains close to its initial form and is discarded without being reduced. The absence of tranchet scars and other evidence for resharpening would support this proposition. Secondly, the handaxe may simply have been discarded in the early stages of reduction before it could be substantially reduced. The large Boxgrove handaxes with tranchet removals discussed earlier would be good examples of this, as they contain a large volume of untapped resharpening potential. Thirdly, handaxes which are made on constrained raw material are more likely to be reduced through a trajectory of edge reduction which retains a longer cutting edge, particularly where the butt of a handaxe is unworkable and therefore retains a large element of cortical surface. This is certainly the case at Cuxton and can be used to explain the large cortically butted handaxes with extremely long, thin tips as a best-fit approach to use and resharpening of handaxes made on pipe flint.

7.6.2 TIP-INCLINED / BALANCED

Handaxes which are tip-inclined or balanced consist of a tip/butt ratio that approaches 50/50. Here there are two trajectories that could produce this form.

Firstly, a tip-centric handaxe which has been reduced from the tip will become a tip-inclined handaxe as the tip is truncated. This will likely be visible through tranchet blows and other signs of resharpening. The angle between tip and butt is likely to become steeper as resharpening progresses. Handaxes resharpened in this way are more likely to have a butt that is not constrained as the form necessitates the maintenance of a long-continuous cutting edge which cannot be solely reliant on tip length. Secondly, as evidenced in the raw materials model (White, 1998a), tip-inclined handaxes can be created as initial preferred forms where their creation is possible. Looking at the relative refinement of the tip may be informative in this case as it will be negatively impacted by resharpening compared to the refinement of a tip which has been created deliberately to be balanced with the butt. The presence or absence of evidence for resharpening on the tip is one way to distinguish the products of these two different trajectories.

7.6.3 BUTT-CENTRIC

Handaxes which are butt-centric consist of a tip that is less than 45% of the total length. The continuum models concurs with White's (2006) assessment of butt-centric handaxes as worked out ovates and adds that the tips of butt-centric handaxes can be less refined than the butts due to the intense resharpening leaving only the stub of the tip remaining on the handaxe, moving it closer to the point of maximum width. The redundancy of traditional measurements of refinement is most clearly demonstrated by butt-centric handaxes which can be distorted by intensive resharpening. Butt-centric handaxes are most likely to show the incipient twist indicative of unifacial tip reduction.

The bout coupé trajectory outlined in the previous section indicated that the path followed to create this type of tip-dominant handaxe combined methods of edge and unifacial resharpening as an effective method of maintaining edge length and overall handaxe length. Bout coupé handaxes are almost entirely tip as the edges are worked right back into the butt, creating a point of maximum width in the bottom 20% of the handaxe. The combination of edge and face reduction allows the handaxe to retain a thin profile which does not have a characteristic weighted butt end. It is not easily demonstrable at which stage in the knapping process the archetypal triangular shape was created, although the evidence from Lynford of recycling and the high level of removals per cm of length on Lynford handaxes suggests that the handaxes from this site were in a later stage of resharpening.

The high instance of plano-convexity on Lynford handaxes is a feature that Soressi (2005) has also described in relation to MTA assemblages from South-West France. She sees it as a feature of resharpening methodologies where flakes are removed from the edges across one face, as described in the unifacial edge trajectory. However, plano-convexity at Lynford can also be partially attributed to another factor, the use of flakes as blanks for handaxe manufacture as opposed to the reduction of a complete nodule. Whilst flake-based handaxes are not always possible to identify if the remnant platform has subsequently been retouched, there are some examples of handaxes at Lynford which retain a remnant platform (Figure 7.38a), and also partially worked (b) and unifacial handaxes which are only partially worked on the dorsal face of the handaxe (c and d).



Figure 7.38: Flake based handaxes from Lynford – (a) 40015 (b) 40223 (c and d) 40416 (KE).

The differing type of blanks used at Lynford, together with the unique combination of resharpening trajectories used to create a *bout coupé* handaxe, point towards a more fluid form of handaxe reduction which can take many trajectories, including those outlined above. The range of planforms exhibited at Lynford show that Mousterian hominins were capable of exploiting a large range of forms and had a less rigid concept of initial form than Acheulean hominins. However, metrical analysis indicates that although the relationship between length and position of the maximum width was fluid in Mousterian handaxes, the same cannot be said for the relationship between length and width. Figure 7.39 (below) shows that there is a more significant relationship between length and width for Mousterian handaxes than for Acheulean handaxes. The maintenance of a width that is approximately two thirds of the length is maintained across the spectrum with a much tighter distribution than for the Acheulean assemblages.

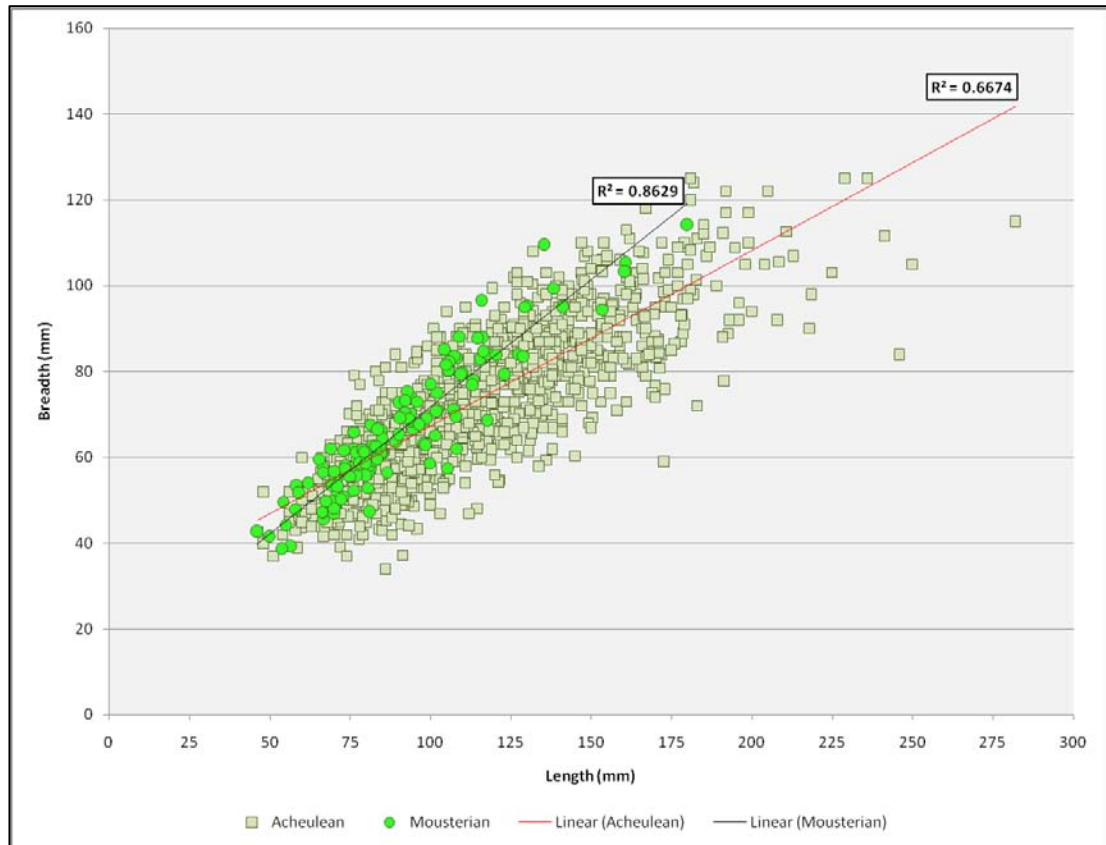


Figure 7. 39: Metrical comparison of Acheulean and Mousterian handaxes for length and breadth.

The balance between fluidity and rigidity is also shown at Lynford through handaxes with extensive recycling (White, *in prep*) and handaxes with scrapers and notches (Figure 7.40, below) incorporated into the edges, suggesting a multi-functional approach to handaxe manufacture and use. This is supported by Soressi's (2005) work on usewear and morphology that concludes that French MTA handaxes are used for a multitude of purposes. Without the availability of usewear traces on British MTA handaxes, this correlation can only be suggested rather than proven.



Figure 7. 40: Large handaxe from Lynford (40354) with notched edge (KE).

7.7

DISCUSSION

The most important aspect of the continuum model is that handaxes need to be considered as individual dynamic objects as well as constituents of a larger assemblage. Whilst it is important to be able to compare assemblages from different sites through the application of shared techniques and terminology, each object has been subject to its individual use-life and discard, evidence of which is often retained on the surface of the handaxe. Just as the different episodes of use have been recorded in rare situations that can demonstrate use, resharpening and then re-use (Soressi and Hays, 2003), it is also possible to extract information about the trajectories of resharpening which have been used to create the final discarded form. Whilst the categories of resharpening trajectories and their explanation through the continuum model incorporate much of the variety found within extant handaxe assemblages there will always be exceptions to the rule, idiosyncrasies that cannot be

explained by resharpening or raw material. One of these is the ‘giant cleaver’ excavated by Wenban-Smith (2004) which is far too large at 179mm long to represent a heavily resharpened handaxe. Just as the existing terminology is incapable of adequately capturing the continuum of variation inherent in handaxe assemblages, no model is going to be capable of explaining all of the handaxes in the archaeological record. What can rarely ever be accounted for within the rigid structure of a model is individual flair and creativity, or a tool created *ad hoc* to suit a particular unique circumstance.

Throughout this research I have attempted to provide a definitive answer to the question of what causes variation in handaxe form. It has become apparent that it is not possible to produce an authoritative statement that pinpoints the source of all variation in British handaxe assemblages. This is because the creation of a handaxe is a constant mediation between internal and external factors including environment, raw material availability and quality, resharpening and individual skill and intent. I have demonstrated over the course of several chapters that some of these factors are more influential than others, and in particular that resharpening accounts for a large proportion of variation. The final chapter will return to the beginning of the research and revisit the aims and questions outlined at the outset of the work to assess to what extent these have been met and answered. This thesis will conclude with a summary of future directions and possibilities that have been suggested through the insights gained in the course of this research.



CONCLUSION

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The introductory chapter of this thesis outlined the aims and questions which were intended to form the core of the research. In the concluding chapter, I will assess the extent to which these aims and questions have been addressed. The purpose of undertaking my research at the outset was the '*investigation of the nature and causes of variability in handaxe form.*' The aim of the study was to attempt to understand the factors that produced a visible range of variation in handaxe form and to reconcile the opposing theories that had been proposed to explain variation. Working with this aim in mind, two key questions were posed in the Introduction:

- ❖ Is there a common causal factor that governs variability in the form of handaxes throughout the British Palaeolithic?
- ❖ Can metrical variability be explained through a single unified approach to handaxe form?

In addition to these main questions, there was also a subsidiary question that stemmed from the original impetus to study handaxe form:

- ❖ Are Mousterian handaxes metrically different from Acheulean handaxes?

In order to find an avenue for answering these questions, I outlined three contrasting hypotheses which posited different causal factors as the possible primary influences that govern handaxe shape. A summary of each of these hypotheses is outlined below:

❖ **RAW MATERIALS HYPOTHESIS** (White, 1998a)

- Handaxe form is directly related to the type, size and quality of raw material;
- Poor raw material leads to the production of pointed handaxes;
- Ovates are a preferred form.

❖ **RESHARPENING HYPOTHESIS** (McPherron, 1995)

- Form is directly related to the intensity of resharpening;
- Variation in form is due to different intensities of resharpening;
- Resharpening leads to a trajectory of forms from pointed to ovate;
- Resharpening is independent of raw material.

❖ **CULTURAL HYPOTHESIS** (Wenban-Smith, 2004)

- Variation linked to social factors that transcend geographical and temporal boundaries;
- Variation can be examined through the identification of unique cultural forms and a preferred form.

By reviewing these hypotheses and examining the evidence for them I will assess the extent to which I have been able to provide an answer to the first key question – Is there a common causal factor that governs variability in the form of handaxes throughout the British Palaeolithic?

As summarised above, the raw material hypothesis contends that raw materials are the primary causal factor behind variation in handaxe form. In Chapter 5, I examined this hypothesis by looking at the correlation between raw material type and quality, and the dominant handaxe type within each assemblage. The results demonstrated that, for the majority of assemblages, there is a correlation between raw material type and quality and the dominance of pointed/ovate forms.

However, there is too much variation both within and between assemblages to justify a simplistic split between points and ovates, despite the general trend identified by Roe (1968). An examination of the basis of the Roe (1968) methodology in Chapters 3 and 5 revealed that there are flaws inherent within this bimodal assignment, mainly relating to the semantic connotations of the terms ‘point’ and ‘ovate.’ In essence, what White (1998a) is saying in his raw materials hypothesis is that conditioned handaxes made on poor raw material have relatively longer tips than those made on good quality raw material. Despite the widespread use of the terms ‘point’ and ‘ovate’, the assumption that they can be used to describe handaxe shape is a fallacy.

The research undertaken in this thesis indicates that there are some grounds to suggest that raw materials do have an important role to play in the causes of handaxe variation. I would suggest that raw materials are the initial causal influence when handaxes are being knapped and shaped. The choice of raw material is the first decision that a knapper makes, through the selection of the most suitable piece of raw material. Decisions concerning the approach to the initial knapping sequence are to a variable extent conditioned by the raw material, as can be the intended outcome.

Furthermore there is also evidence to suggest that a primary aim in the initial production of a handaxe is the creation of a long “straight” cutting edge which may explain why the handaxes at Cuxton are shaped in such a way. After the initial knapping sequence is completed, raw material is relegated to a secondary influence and resharpening becomes the primary causal factor. A necessary by-product of this theory is that White’s (1998a) notion of preferred form is only very rarely to be found in the record, especially as the metrical analysis in Chapter 5 indicated that there was more variation in the dominant form from each assemblage (which is presumed to be the preferred form).

8.3

RESHARPENING HYPOTHESIS

The resharpening hypothesis, as proposed by McPherron (1995) has been the most studied theory in this thesis. This is in part due to its accessibility and ease of replication compared to the other theories, but also because McPherron suggested definite trajectories of form through resharpening which were in sharp contrast to the ideas of White (1998a). Chapter 3 outlined the central tenets of the resharpening hypothesis which were then put to the test in Chapter 5. Research into McPherron’s (1995) theory indicated many flaws in methodology, basic assumptions and interpretation which undermined his assertions regarding the British dataset.

Despite these flaws, the basic premise of the key role of resharpening still stands, although not on the basis of a trajectory from pointed handaxes to ovate handaxes. The key concept of the relative ratio of butt to tip provided the basis for the exploration of resharpening in Chapters 6 and 7.

Through the examination of the raw materials hypothesis I have demonstrated that resharpening is not independent from raw material and in Chapters 6 and 7, I have asserted that resharpening is the primary cause of variability in handaxe form as represented in the archaeological record. The analysis of McPherron's (1995) resharpening theory in Chapter 5 indicated that there was a large level of variability in planform that could not be tied to either raw materials or a dominant planform type. There appeared to be a generalised preferred planform which led to the creation of handaxes with tips that were between 50% and 80% of the total length. The patterning McPherron (1995) had discovered in measures of elongation and refinement was shown to be artificially replicable without a trajectory of resharpening from point to ovate and, in the case of refinement, to be misleading as a measure of relative thickness.

The examination of edge sharpening patterns in Chapter 6 demonstrated that there were non-random patterns of resharpening demonstrable within the majority of sites in the study, and that this patterning was distinct to each site. Both Chapters 5 and 6 produced results that indicated the presence of a trajectory of resharpening which was linked primarily to the reduction of the handaxe tip. The observations from these two chapters were brought together in Chapter 7 where the physical and metrical evidence for the resharpening of handaxes at Boxgrove was discussed and compared to other sites in the dataset. Chapter 7 outlined a semantic-free terminology which related directly to the ratio of tip to butt and produced good patterning in the dataset assemblages. Furthermore, through observational and methodological studies, I was able to propose a number of resharpening trajectories through which a handaxe could be reduced, outlining the consequences on the overall form of the handaxe. The conclusions also supported the notion that preferred form was going to be difficult to

demonstrate unless a handaxe had been discarded rapidly after the initial knapping sequence, from an unconditioned knapping episode. The examination of handaxe trajectories and an assessment of the stage in the use-life of the piece at which it had been discarded were promoted as ways of measuring resharpening.

The examination of resharpening trajectories and the notion of differential use-life stages in the cycle of creation, use, resharpening, reuse and eventual discard prompted the outline of a model to explain variation within handaxe assemblages. The continuum model, as discussed in Chapter 7, is built on the work of McPherron (1995) but does not see a continuum of reduction that results in the form of handaxe changing from point to ovate. Instead it sees handaxes with longer tips being reduced into handaxes with relatively smaller tips as one of several methods of reduction which affect the shape of handaxes and produce a continuum of form. Each individual handaxe may have undergone one or more episodes of reduction, leading to a multiplicity of explanations for handaxe variability. The pitfalls of the McPherron theory, namely that the patterns he described could be recreated without resharpening along with the misinterpretation of standard ratios, can be avoided by using the fluidity of the continuum model to explore the dynamic plurality of handaxe manufacturing techniques.

Tip-centric handaxes may represent the best fit approach to an intractable piece of raw material, or simply represent a handaxe in the early stages of reduction. Balanced handaxes may have been preferentially manufactured that way or have been reduced down from a tip-centric planform. Butt-centric handaxes demonstrate the redundancy of the cleaver terminology as they may not present a traditional cleaver-type edge and are most often to be seen as the result of an intensive reduction

strategy. The plurality of explanatory frameworks epitomises the way in which we should be measuring and recording variability, at the level of individual objects.

The process of identifying resharpening is primarily achieved by recording the most visible forms of resharpening, through edge modification in the form of tranchet removals. It should also be possible in the majority of cases to identify the trajectories of resharpening that have been utilised in the manufacture and maintenance of each handaxe. Most importantly, the recognition that a handaxe is not a pristine object which has been discarded in the form that it was initially envisaged or created, allows the researcher to fully understand the impact of resharpening on an assemblage. By working with all elements of an assemblage, the role of handaxes and resharpening can be more accurately assessed.

8.4

CULTURAL HYPOTHESIS

The preceding discussion seemingly leaves little room for the role of other factors in the manufacture and discard of handaxes in the archaeological record. At the outset of the research, I expected to be able to identify distinctive forms of handaxe as attributable to a cultural or behavioural grouping that was unrelated to external environmental factors. However, one of the central claims of the continuum model is the incorporation of the majority of these forms into either initial raw material constraints or subsequent trajectories of resharpening. Plano-convex and twisted handaxes became a byproduct of resharpening over design.

However, the question still remains, is there any evidence to support the cultural hypothesis that certain types of handaxes are socially mediated? I believe that it is

not possible to attribute a whole group of handaxes to individual preference or design, yet there are individual cases which cannot be easily subsumed in the more functional prosaic explanations for handaxe variability. Good examples are the two recently discovered handaxes from Cuxton (Wenban-Smith, 2004), a giant ficron and a giant 'cleaver' in the metric and traditional sense. Clearly the existence of a large cleaver-type handaxe is difficult to explain within the notion of cleavers being highly resharpened types. Undoubtedly, there will always be outlier examples which do not conform to the norm.

With reference to the resharpening trajectories outlined in Chapter 7 and the discussion of preferred form above, it could be argued that a repetition of a particular resharpening trajectory or the deliberate imposition of a mental template could have more than a functional purpose and represent cultural mediation. With further study of the frequency and distribution of resharpening trajectories within and between assemblages, it may be possible to assign some strategies to a cultural 'tradition' of manufacture which is learned and replicated. Certainly, the temporal limiting of the majority of twisted handaxes to MIS 11 would warrant further investigation.

Combined with the gut-feeling that many Palaeolithic researchers experience regarding the over-engineered nature of some handaxes, particularly in the imposition of seemingly functionless symmetry (Machin, 2006), it is obvious that a degree of individual action and socially mediated innovation cannot be ruled out of the British Palaeolithic. Unfortunately, it is difficult to isolate factors that would concretely define the cultural imposition of form in a similar fashion to the model presented here about resharpening.

In summary, the aim of identifying the common factor that governs variability in the form of handaxes in the British Palaeolithic has been answered, albeit in a fashion that is able to promote different factors (raw materials and resharpening) as the primary influence on variability dependent on the stage at which the handaxe is discarded.

8.5 A UNIFIED APPROACH TO HANDAXE VARIABILITY

The previous section has already touched upon the approaches to handaxe variability that have been examined and proposed through the course of my research. The primary methodology used in the thesis was the exploration and testing of other researchers' theories, in order to assess the validity and applicability of their approach. The aim was to try to find a method of unifying the approach to handaxe variability which moved beyond current conflicting theories.

The examination of Roe's (1968) methodology highlighted that, although the methodology for measuring and categorising handaxes provides a good baseline for comparing assemblages, the division of handaxe assemblages into point- and ovate-dominated had become confused, as the terms suggested differing shapes as opposed to what was actually a difference in the percentage of butt to tip. It also became apparent that dividing all handaxes into only three types subsumed the great level of variation both within and between assemblages.

White's (1998b) approach to raw materials and handaxe type was difficult to replicate and, it could be argued, is open to the subjectivity of individual researchers.

Although the conclusions of the raw material hypothesis proved to have some merit, the methodology could not be used as a consistent approach to measuring and categorising handaxes across the spectrum. On a more fundamental level, such as that applied in my thesis, the assignment of a general raw material type and quality can be recorded and compared to the types of handaxes being studied and the strategies used for resharpening.

McPherron's (1995) approach to resharpening and tip length was much scrutinised in Chapter 5 and was found to be flawed in a number of its assumptions and conclusions. However, the notion of tip length and the impact upon it of resharpening proved to be a key element in the causal factors behind handaxe variation.

Despite the inherent difficulties in producing a unified approach to the study of handaxe variation, as demonstrated by Roe (1968), White (1998b) and McPherron (1995), I believe that it is possible to combine the best features of these theories into a coherent whole. The continuum model, as outlined in Chapter 7, is a synthesis of the most useful aspects of Roe, White and McPherron, combined with the key observations and conclusions of the present study, amalgamating opposing points of view into one approach to variability that provides typological categories without obscuring the totality of variation demonstrated in the course of this research. The model provides different levels of interaction, from basic categorisation through the use of categories of tip-centric and butt-centric, to higher level identification of resharpening trajectories and the implications of these trajectories. The outlined methodology allows a researcher to engage with the model at whatever level is most appropriate for the purposes of his/her work and allows cross-study comparisons to be undertaken.

So, in answer to the question ‘Can metrical variability be explained through a single unified approach to handaxe form?’ I would conclude that it can be addressed through the application of the continuum model which would see the use of both metrical and observational techniques that could easily incorporate evidence from other avenues such as use-wear if this information was available.

8.6

MOUSTERIAN VS ACHEULEAN

The third and final question suggested in the introduction was related to the assertion made by Collins and Collins (1970) that Mousterian handaxes were metrically distinct from Acheulean handaxes. Although a subsidiary question which would not be directly examined in the course of the study, it was possible through the analysis to produce some data to consider this question.

The majority of Acheulean handaxes were Tip-centric and Tip-dominant and there was also a reversal that saw tip-centric handaxes being made on good quality raw material. In part, this reversal is due to the manufacture of *bout coupés* which are almost 100% tip which I believe is due to a unique resharpening trajectory as outlined in Chapter 7. This trajectory incorporates the reduction of edges and faces which results in increasingly tip-dominant handaxes which are often plano-convex in profile. This trajectory allows the maintenance of overall length and also cutting edge length which allows the functionality of the handaxe to be maintained for longer. The *bout coupé* trajectory is the only trajectory which sees reworking of the butt occurring. The impact of such resharpening on the position of maximum width in part explains the greater variability in planform noted in Chapter 5.

The analysis that took place in Chapter 5 suggested that handaxes in the Mousterian were quantitatively different, particularly in planform, but not so substantially different to produce a statistical correlation. The small sample size of Mousterian handaxes in the dataset contributed to a lack of comparability between the majority of assemblages, however a meaningful comparison was possible between Lynford and Boxgrove, which showed that the quality of raw materials at both sites led to an overall similarity in the main measures and ratios, with the exception of planform. When examined further in Chapter 7, it was suggested that this was due to a more fluid concept of handaxe manufacture and functionality which led to the creation of more ‘extreme’ handaxe forms such as the *bout coupé*, showing that Mousterian hominins had the ability to manipulate flint in a more flexible manner than Acheulean hominins. Unfortunately it is not possible to demonstrate whether handaxes at Lynford were being used for different functions than those at Boxgrove due to a lack of usewear traces.

Handaxes at Lynford averaged by far the highest number of removals per cm of edge of any of the handaxe assemblages in Chapter 5 at 1.21 removals per cm of edge, which is partly due to the intensive resharpening of relatively short handaxes. It is also a reflection of the greater reduction intensity undergone by the handaxes from Lynford, indicative of the capacity of Mousterian hominins to extend the use-life of handaxes by incorporating scraper edges and notches onto the edges of handaxes (White, *in prep*). Boxgrove was the next highest at just over half the number (0.65). Higher numbers of removals also lend support to the idea that Lynford handaxes are highly resharpened, more so than any in the Acheulean. This may be a consequence of the differentiation of sites in the Mousterian as suggested by Soressi (2005). She presents evidence that shows French Mousterian sites contain handaxes and debitage

from different stages in the manufacturing process and extrapolates that some are being used as procurement and roughing out sites, with others only containing ready-made handaxes which are resharpened then discarded. Although the sites that she uses as examples are temporally separated by too many years to present a concurrent pattern, the evidence from Lynford classifies it as a tertiary stage site with a lack of initial shaping debitage and a proliferation of resharpening, recycling and discarded handaxes. As the material is of local origin, the handaxes are unlikely to have been transported any great distance before discard but show a difference in approach to that of Boxgrove where procurement, roughing out and handaxe manufacture and discard all take place at the same site. This may either suggest a different level of planning depth, greater mobility resulting in longer use-life's for individual handaxes (Shott, 1996) or simply a different imperative – in the case of Lynford it may have been a suitable hunting/scavenging arena but not a suitable site for residence.

The discussion of *bout coupé* handaxes in Chapter 6 showed that there was a more direct correlation between length and width in handaxes from the Mousterian assemblages which indicates that there was a more rigid adherence to the maintenance of this ratio than in the Acheulean. This is coupled with evidence for recycling and multi-faceted handaxe edges which indicate fluidity in handaxe conceptualisation not evidenced earlier. Taken together, this suggests that Mousterian hominins had greater control over the creation and maintenance of handaxes which allowed them to impose rigidity over some aspects of form and also to extend utility in a fluid manner.

There is not enough evidence from the analysis of Mousterian handaxes in this thesis or in the majority of studies of British Mousterian sites to suggest a concrete reason

for the reintroduction of handaxes into the toolkit after a long period of absence. The lack of intervening sites during the abandonment of Britain is a key obstacle in tracing the development of technology between the Levallois and MTA. New sites in continental Europe that date to MIS 6 (Roebroeks, *pers. comm.*) may shed some light on this issue in the future. Personally, I believe that handaxes were reintroduced in the MTA in order to fulfil a similar need to their Acheulean counterparts. However, as with modern technology, the new model MTA handaxes were more versatile and incorporated more features than the earlier models which allowed Neanderthals more flexibility when recolonising Britain at the end of MIS 4.

8.7

FURTHER WORK

As with any work of this scale and scope, each question that has been answered produces yet more questions to answer. Primarily, the work that has been done at Boxgrove, which produced the continuum model, needs to be repeated at other sites, with a concentration on identifiable trajectories of resharpening and the residual features of resharpening. It would also be informative to increase the emphasis on the relationship between the environment and the site, particularly with reference to the trajectories which are more commonly utilised when raw material is scarce.

The formulation of the continuum model came at a late stage in this research, so it should be possible to refine it further and support the conclusions drawn from the model as applied to Boxgrove with the addition of more data from other sites. Whilst the fluid and relatively uncomplicated structure of the model is a deliberate feature, the continued examination of the relationship between the different handaxe types

and the relative benefits of the differing ratios between butt and tip should allow for a stronger definition of the types.

A recent paper by Shott and Ballenger (2008) explores the concept of measuring the ‘extended utility’ of handaxes in North America. The ability to quantify the amount of reduction that has taken place without the current necessity of having a full refitting reduction sequence would be very pertinent to this debate and represents a potential future avenue in the amendment of this methodology for use with British handaxe assemblages.

The continuing question of the nature of variation between Mousterian and Acheulean handaxes provides another avenue of future work. By applying the concept of resharpening and continuum to this question it should be possible to further examine and quantify the relationship and, in doing so, to elucidate some of the factors which produce variation as well as the reasons for the reappearance of handaxe-dominated assemblages in the late Middle Palaeolithic.

8.8

EPILOGUE

When examining variability from a metrical and mathematical point of view, it is easy to become too focussed on the object itself and forget that the ultimate reason for studying variability in handaxe form is to try to discover the motivations and behaviour of the hominin/s that created and used it. Through the work undertaken in this thesis, it can be demonstrated that the processes of manufacture, use and discard are complex and combine aspects of external conditioning and individual choice. The

availability of good quality raw material is a key factor in the use-life of a handaxe – it affects the type of handaxe that is created and also mediates the choices that are available for the continuing use and resharpening of the handaxe. The research in Chapter 7 indicated that, in some instances, hominins choose to discard handaxes early in their potential use-life, whereas others are resharpened to exhaustion. The fact that both ends of this spectrum can be demonstrated on one site (Boxgrove) indicates that the earliest handaxe-making groups in Britain exhibited control over production and use of tools, and chose to resharpen when necessary.

The realisation that preferred form is not as accessible as previously suggested (White, 1998a) does not necessarily strike a blow for researchers looking for evidence of mental templates and hominin thought processes. Through the identification and examination of resharpening trajectories, it should be possible to reconstruct the pathways of knapping. Through these pathways and trajectories, we can gain insight into the decisions being made by Palaeolithic hominins and speculate on the reasoning behind them. For example, the maintenance of a long, sharp cutting edge through the resharpening process, indicates that functional concerns were paramount in its use. The retention of symmetry in some handaxes that have been extensively resharpened also indicates some further aspect of hominin behaviour that can be seen through discarded tools.

The differences between handaxes in the Acheulean and Mousterian were not proved to be as great as expected, however the extensive use of resharpening and recycling evidenced at Lynford, along with the use of handaxe edges to support other tools suggests that conceptually, Mousterian hominins thought differently about their tools. Whilst fundamentally similar, and likely used for a similar purpose, the design

of Mousterian handaxes was more fluid and did not conform well to the predictions of models designed to interpret Lower Palaeolithic handaxes (White, 1998, McPherron, 1995). This interpretation suggests that Mousterian hominins were more in control of the knapping process, less conditioned by raw material constraints and utilised resharpening trajectories that were more sophisticated than those used in the Acheulean.

Whilst the promotion of raw materials and resharpening as the key influencing factors controlling the production and use of handaxes in the Palaeolithic would suggest that cultural mediation bears little weight in the final product, it is demonstrable that some aspects of cultural behaviour can be seen in the archaeological record. Overall, it can be argued that the creation of a tool is inherently a cultural process which is more than likely learned through imitation or teaching. Giant handaxes, highly symmetrical handaxes and other types which do not conform to a functional and normative plan can be said to represent cultural behaviour. The use and selective discard or curation of handaxes also reflects behavioural practices which fall beyond the boundaries of function and conditioning. Through the continued refinement of the continuum model, it is hoped that more of these processes may become visible.

By resurrecting resharpening as a primary causal factor in the creation of variability in handaxe form, it should be possible for lithic researchers to move away from dichotomous classifications that force variation to conform to strict definitions of black or white and point or ovate. Purely metrical schemes, such as that outlined by Roe (1968), are wholly inappropriate for the study of continuums, where the resultant form of a handaxe is governed by the trajectory of resharpening chosen by

the knapper. What has been demonstrated over the course of my research is that variation is fluid and therefore poorly suited to the study of opposites. Whilst a scheme of classification is preferable at the most basic level of comparison, the higher levels of interpretation and causality require a more subtle approach, which can only be achieved by examining individual objects and accepting that there may be a range of influencing factors that differ in importance from site to site.

This search for the causes and features of variation in the handaxe-dominated assemblages of the British Lower and Middle Palaeolithic has been both challenging and rewarding. It has also required a change of perception from both a linguistic and conceptual point of view. Through the application of the Continuum Model, it should be possible for lithic researchers to engage more fully with the chaîne opératoire. Handaxes can no longer be seen as pristine end-products or as part of a simplistic relationship between intention and form. From a static metrical entity, the handaxe has now gained increased dynamism as a result of its placement within a continuum of use-life from creation to discard. The recognition of resharpening trajectories allows us to interpret the functional, contextual and symbolic aspects of handaxe manufacture, use and discard. The Continuum Model presents a fresh starting point for interpreting handaxe variability which will allow for the reinterpretation of old sites and provide a framework within which to consider future sites. In doing so, we will gain a new perspective on the cognitive, social, ecological and technological spheres of human evolution in the British Lower and Middle Palaeolithic.

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